AUGUST 15, 1957

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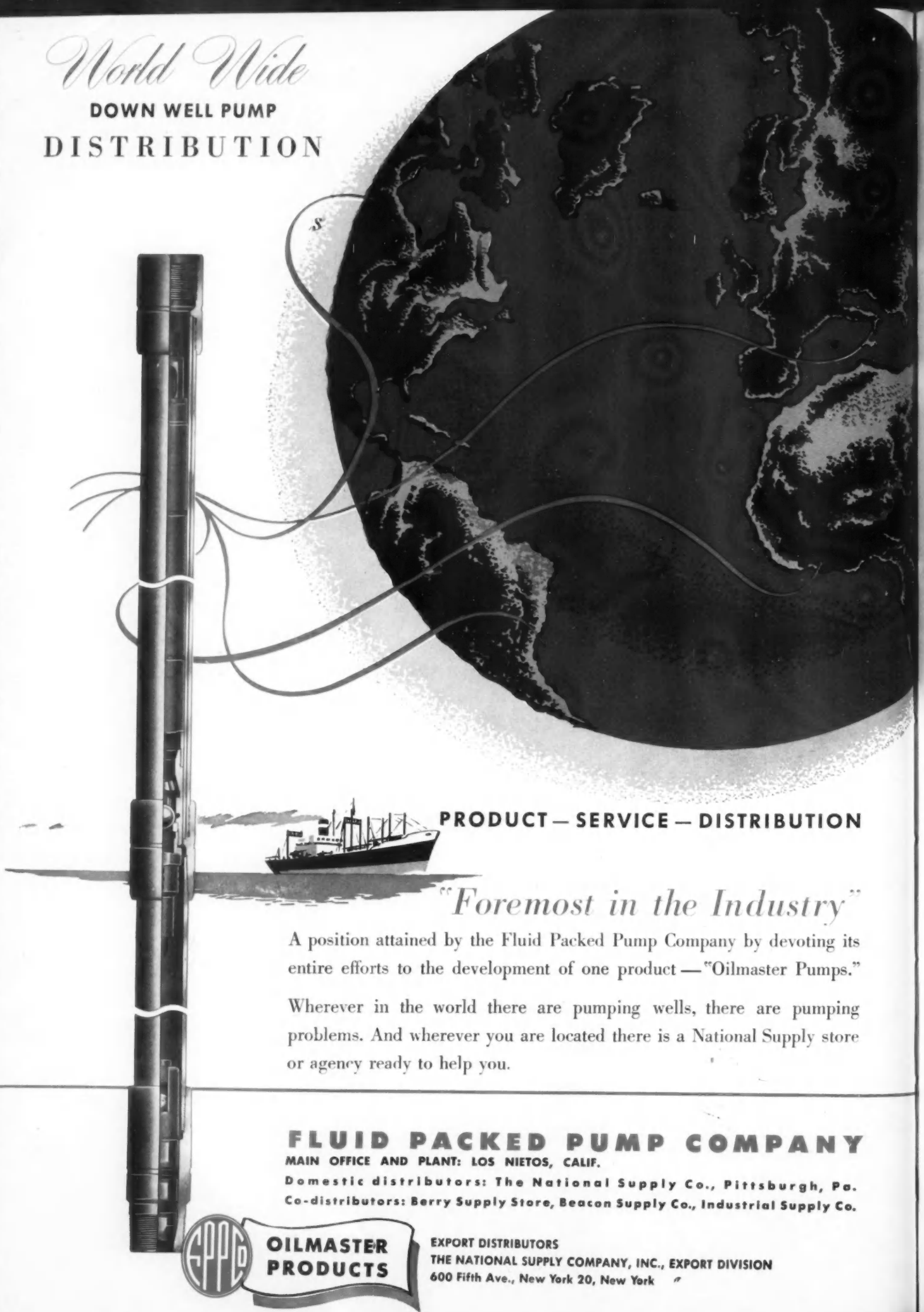

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Turn the page for a Quick Look at this issue ▶

a QUICK LOOK at this issue . . .

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following page.

U. S. Oil Industry's Immediate Prospects Brightening

THE COMPLEXITIES of the U. S. petroleum industry, which represents a major segment of the nation's economy, again have been sharply outlined by the recent end-of-July pronouncement by the government calling for voluntary 20 percent reduction of imported oil.

To fully understand reasons for this high-level request and its impact upon the world's leading crude producing industry, a factual evaluation of every facet of the domestic industry is essential. And toward that end, WORLD OIL has prepared, beginning on Page 118, a thorough presentation of the past, present and likely future of the nation's oil industry:

Included in this presentation are the latest figures on:

- Demand, which, with a daily average of 9,615,000 barrels, is expected to reflect a normal growth of 4.7 percent this year (Page 118).

- Production, which domestic producers are hoping can be increased before year's end (Page 120) in accordance with the government's voluntary imports curb (Page 127).

- Drilling, WORLD OIL's forecast for which indicated completion of 13.5 percent more wells and 12.5 percent more footage during the last half of 1957 than in the first six months (Page 122). This level of activity is expected to increase the number of new producing completions to 17,793, or 1886 over the first half (Page 125).

Venezuela Oil Progress on Eve of Even Brighter Future

ALREADY THE WORLD'S No. 2 crude producer and No. 1 oil exporter, Venezuela is embarking upon an era of even greater development, thanks largely to the granting of the first new petroleum concessions since 1945 (see Page 132 and maps on Pages 136, 137, 138, and 139).

Warren L. Baker, WORLD OIL's editorial director, who spent four weeks touring Venezuela's oil fields and installations in behalf of this International Outlook Issue, returned with a wealth of facts and figures which together spell out for the nation an optimistic oil future. Baker found that:

- Since July 4, 1956, 36 companies, including partnership interests, have paid $685 million for slightly more than 2 million acres of new concessions (Page 131).

- Daily average crude production during 1956 was 2,456,785 barrels and that during the first five months of 1957 it was 2,885,883 barrels, which put the producing rate currently at more than three times the 1945 rate (Page 134).

- Venezuela's proved crude reserves—estimated at almost 14 billion barrels—and gas reserves—estimated at almost 27,000 billion cubic feet—are expanding rapidly (Page 140).

- Drilling rates have more than doubled during the past 10 years (Page 142).

- The market outlook is bright for Venezuelan crude (Page 144).

- Domestic consumption is expanding (Page 145).

Canada on Brink of Unprecedented Record Operations

ALTHOUGH CANADA'S 1956 operational level established still more records, this year's activities already have eclipsed many of the developments recorded last year.

Drilling rates this year, for example, are expected to spiral as 3600 wells are expected to be drilled in Western Canada alone by year's end, as compared with 3309 wells in 1956 (Page 146).

For the facts and figures supporting ever-brightening prospects in Canada, see Page 146. With crude production of 522,400 barrels now 25 times more than in 1947 (Page 150), and wildcats leading to more and more significant discoveries (Page 150), proved and potential reserves, coupled with available acreage, are beckoning oil industry's interest on a more expanded scale (Page 152).

The natural gas industry, too, is facing the immediate and long-range future with unexcelled prospects as gas drilling is expected to increase along with the price of gas and gas reserves (Page 156).

Turn the Page

WORLD OIL, published every month except semi-monthly in February and August. Entered as THE OIL WEEKLY as second class mail matter December 23, 1916, at postoffice at Houston, Texas, under the act of March 3, 1879.

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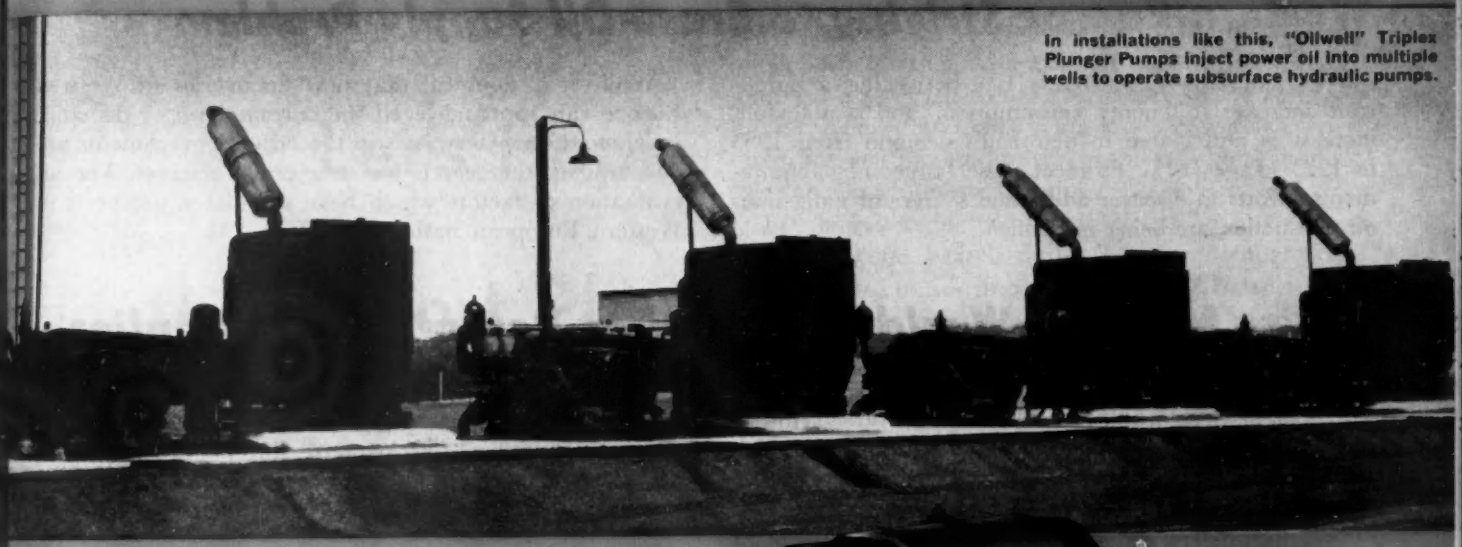

In installations like this, "Oilwell" Triplex Plunger Pumps inject power oil into multiple wells to operate subsurface hydraulic pumps.

324-P and 326-P Triplex Plunger Pumps have proven to be dependable surface units for subsurface hydraulic pumping installations. They can be run at operating pressures for efficient production, yet can develop the very high pressures when it is necessary to dislodge and raise the subsurface pump.

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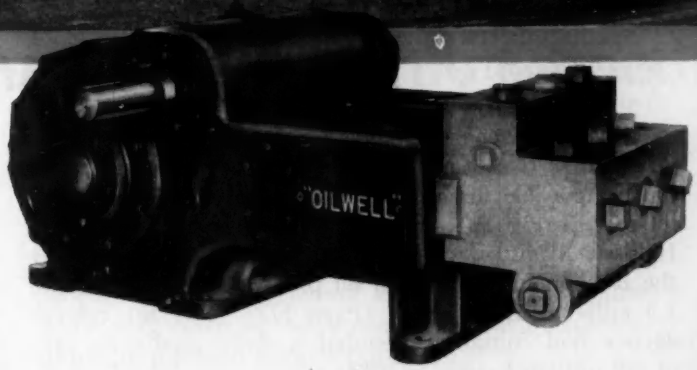
Plunger Size Inches	Maximum Continuous Pressure 4" Stroke	6" Stroke
1⅛	5,000 psi	5,650 psi
1¼	4,080 psi	5,650 psi
1⅜	3,370 psi	5,650 psi
1½	2,800 psi	5,650 psi
1¾	2,100 psi	4,150 psi
2	1,600 psi	3,180 psi
2¼	1,250 psi	2,520 psi

An "Oilwell" Pump Engineer will be glad to give you complete information about the performance of these pumps in subsurface hydraulic pumping operations. Ask for him at your nearest "Oilwell" store.



This 326-P (6" stroke) Pump with forged steel fluid end illustrates the type pump furnished for power-oil injection uses.

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QUICK LOOK at this issue . . .

Western Canada . . . a large wall map

A DETAILED multi-colored oil and gas map of Western Canada has been inserted in copies of this issue going to subscribers in Canada, outside the U. S., New York, New Jersey, and the District of Columbia.

Other subscribers may obtain one free copy of the map by using the blue Reader Service Card at the back of the issue. A space has been provided for requesting a copy. Subscribers desiring more than one copy may obtain additional copies at a price of $1 each. Copies also are available at this price to non-subscribers.

The map, suitable for framing, shows all current Western Canada oil fields, gas fields, pipe lines, and refineries on a township and range background.

Western Europe Striving to Erase Oil Supply Problem

WESTERN EUROPE currently is experiencing a significant increase in energy consumption, and a four-fold increase is anticipated in petroleum demand from 1955 to 1975 (Page 167). To meet these burgeoning requirements, efforts to discover additional sources of indigenous oil production are being intensified.

While it is doubtful that new discoveries in Western Europe can approach even the current level of demand, let alone the greater needs in the offing, governments are encouraging the search for new crude reserves. For an evaluation of factors which have stimulated prospects in Western European nations, see Page 170.

Africa Meriting World Attention as Potential Oil Supplier

THE RECENT BLOCKING of the Suez Canal has underscored the importance of Africa's new discoveries. Almost throughout the continent, exploration, drilling and development activities are being accelerated (Page 158). The wide interest which the Continent is drawing stems from the growing consideration that it is a potential crude oil supplier for Western Europe, a matter of prime importance to Western European nations.

Russian Oil Future May Be Affected by Decentralization

RUSSIA'S REVERSAL of policy in a move to decentralize its economy is expected by qualified Western observers to have a possible unhappy impact on the nation's oil industry. During the first five Five-Year Plans, the Oil Industry Ministry, which now has been abolished, guided the Russian industry to an oil production level of about 1.3 million barrels a day (Page 172). Too, the central agency had initially scheduled a daily producing rate of 2.2 million barrels by 1960.

Elsewhere in Eastern Europe, hopes were dwindling in East Germany for a progressive oil industry (Page 178), Czechoslovakia's petroleum efforts were meeting with slow progress (Page 178), Hungary's production declined in its year of rebellion (Page 182), and Rumania's post-war trend of continuing increased crude output was levelling off (Page 184).

Offsetting these declining prospects were oil industry developments in Albania, where production is expected to rise (Page 180); in Bulgaria, whose oil industry has developed a daily average yield totaling 4100 barrels during the past five years (Page 181); and in Poland, whose reported 9 percent overfulfillment of the oil production quota resulted from a daily average yield of 3723 barrels (Page 185).

Yugoslavia, astraddle the East-West political and economic border and benefiting from assistance from each direction, is pointing to a bright petroleum future as it enjoys sufficient technical assistance and funds to enable the country to anticipate a major rise in crude production from its 5800-barrel daily production last year.

Forecast and Review of Remainder of World of Oil

IN ADDITION to the foregoing Special Reports, WORLD OIL's coverage for this issue includes the annually-published details of 1956 achievements and current 1957 progress and plans on every other country where oil is sought and/or produced (Pages 202-320). In addition, worldwide oil industry operations have been summarized by activity: Completions and footage (Page 188); crude production (Page 190); demand (Page 195); and crude reserves (Page 198). Since units of measurements differ throughout the world, a page a Conversion Factors has been included on Page 200 for convenience sake.

Attention, too, is drawn to a summary of new laws and pertinent events modifying and updating WORLD OIL's thorough analysis of world oil laws, which was published in 1951.

Let's Hope the Import Plan Works Out

It is to be hoped that the voluntary U. S. import program proves successful. If it fails to accomplish its aims, the principle of voluntary adjustment of economic problems will be seriously retarded.

Since imports cannot indefinitely go on increasing while U. S. production is cut far below producing ability, failure would leave government enforcement of restrictions as the only resource. This would mean more government control of business. In this case, it would mean federal government control of oil.

If the government enforces oil import restrictions, the federal government for all practical purposes will also thereby be determining how much oil domestic producers can produce.

Everyone will not be satisfied with the plan. The oil import question is so difficult and complex, it is doubtful if any plan would ever satisfy all the various factions. There probably is not any completely equitable answer, almost any program will work hardships on some interested groups.

The largest reduction contemplated for any company is 50,000 barrels daily. Another company is expected to cut its imports by 41,000 barrels per day. No other company has been asked to reduce imports by more than 20,000 barrels daily.

Total reduction sought is 215,000 barrels a day, which should be shared by enough countries as not to work too severe a hardship on any one nation.

It is necessary that U. S. imports be curtailed. The U. S. oil industry already is suffering serious damage. Production has been curtailed in the face of rising U. S. demand. Wells in Texas are permitted to produce a limited amount only 13 days a month. This has resulted in decreased U. S. drilling, which can only lead to an inadequate future U. S. supply.

Ever-increasing imports would further discourage U. S. domestic oil development. There must be a vigorous U. S. program of oil exploration so this nation will have an adequate accessible petroleum supply for national security purposes.

It is to be hoped importing companies will take advantage of this additional opportunity to solve the problem by voluntary means. This is to be preferred to the imposition of mandatory controls.

Warren L. Baker

United States Outlook Is Improving

More favorable conditions are ahead of U. S. producers. Stable normal growth to replace recent extreme demand fluctuations and plan to curb crude imports promises higher producing rates.

THE U. S. OIL INDUSTRY can look forward to more stable operating conditions in the last half of 1957. Gone from the scene will be the widely varying trends which existed the first half of the year.

With the return to more stable operations, less difficulty should be experienced in keeping supply properly balanced with demand and this will be beneficial.

The first half of 1957 was a period of extreme fluctuations for U. S. oil. With Suez Canal closed emergency shipments to Western Europe boosted demand to such heights, supply was short despite record production. Reopening of the canal caused conditions to change by mid-year to surplus supply although producing rates had been curtailed sharply.

In contrast, conditions ahead represent normal growth on which the industry can build for the future.

DEMAND: *Normal Growth*

Total demand for U. S. oils in the second half of 1957 is expected to be substantially larger than in the preceding year. Demand will grow at a steadier and more normal pace than the abnormally wide fluctuations which occurred early in 1957, thus relieving the industry of some of its economic troubles.

It is anticipated total demand for U. S. oils in the last half of 1957 will average 9,471,000 barrels daily, 344,000 barrels or 3.8 percent larger than in the same season of 1956 (see Page 118). In line with normal seasonal trends, demand should rise from 8,874,000 barrels per day in the third quarter to about 10,068,000 barrels in the fourth quarter with the coming of cold weather.

IMPORTS: *To Be Reduced*

The most significant development of the year for U. S. producers may be the restriction of crude oil imports. Substantial reduction would go a long way toward relieving surplus crude conditions, making the outlook much more favorable for domestic producers.

The government has asked for voluntary reduction of crude imports. If fully successful, the program would reduce crude imports to an average of 1,031,000 barrels daily during the rest of 1957 (see Page 127) compared with 1¼ million barrels in recent months.

PRODUCTION: *To Increase*

U. S. producers can hope for some relief from current drastic production restrictions before the end of 1957. If crude oil imports are cut back as planned, domestic producing rates should benefit to the extent of 215,000 barrels daily. This means a daily average production of 7,217,000 barrels during the last six months of 1957 (see Page 120).

This figure is considerably above recent levels of slightly under 7 million barrels per day and also above the last half of 1956, although far below temporary March peaks during emergency shipments to Europe.

DRILLING: *Will Recover*

Improved prospects are expected to result in much higher U. S. drilling rates during the last half of 1957, terminating the slump which existed earlier in the year.

Drilling of 29,594 wells and 122.2 million feet of hole is forecast for the last six months of 1957. In contrast with first half activity, this would represent an increase of 13.5 percent or 3518 wells and 13.6 million or 12.5 percent more footage (see Page 122).

CRUDE STOCKS: *Too High*

U. S. producers still face the necessity of reducing excessive U. S. crude oil stocks, which advanced 30 million barrels between the end of March and end of July. However, increasing seasonal demand and reduced imports promise to solve this problem without requiring further cuts in U. S. production.

More Growth in Prospect Outside U. S.

Further expansion is in the offing for the world oil industry. While demand is expected to increase, development of sources of oil supplies indicates future shuffling of oil supply lines.

THE WORLD PETROLEUM industry is looking forward to the completion of another year of a quickening operational pace, the pattern for which was established during activities recorded during the first half of the year.

With the continuing development of new oil sources, including significant discoveries in oil-short countries, there was every indication that present oil supply lines would be affected markedly in the future.

There was every indication, too, that the industry, at the end of the year, would be able to look back upon considerable progress made by several actual as well as potential crude-producing nations in the field of operational freedom. Numerous countries, which previously had given no particular consideration to opening their doors to private capital operations, were moving during the year toward a reversal of policy.

Such a reversal will lead to even greater levels of oil industry operations and, likely, also will result in the discovery of even more producing areas.

CONSUMPTION: *Big Gain*

Continuing expansion in world demand for crude oil is presaged despite the record-shattering 1956 level of 17,533,000 barrels per day, reflecting a gain of slightly more than nine percent greater than the previous year's gain (see Page 195).

The anticipated increase is expected to occur at a rapid rate in the future. And although Western Europe is accelerating its drilling programs, there appeared little hope that production could keep pace with demand. Europe's spiralling demand stems from the continent's trend toward an oil-fueled economy.

Free World demand, outside the U. S. is expected to rise by 80 percent in the next decade.

PRODUCTION: *New Peak*

Crude producers outside the U. S. can expect to furnish another record oil supply this year, with prospects favorable for still greater production during 1958 as demand rises. The 1956 total world output of 6,102,116,000 barrels, or almost 16.7 million barrels per day (see Page 190), amounted to an increase of more than eight percent from 1955.

New oil discoveries, in Northern Africa among others, and increased production, i.e., in Venezuela, where 1956 output reflected a significant 14.2 percent gain from the previous year, were expected to join the large producers like the U. S. and Middle East in boosting the world's total output to greater heights.

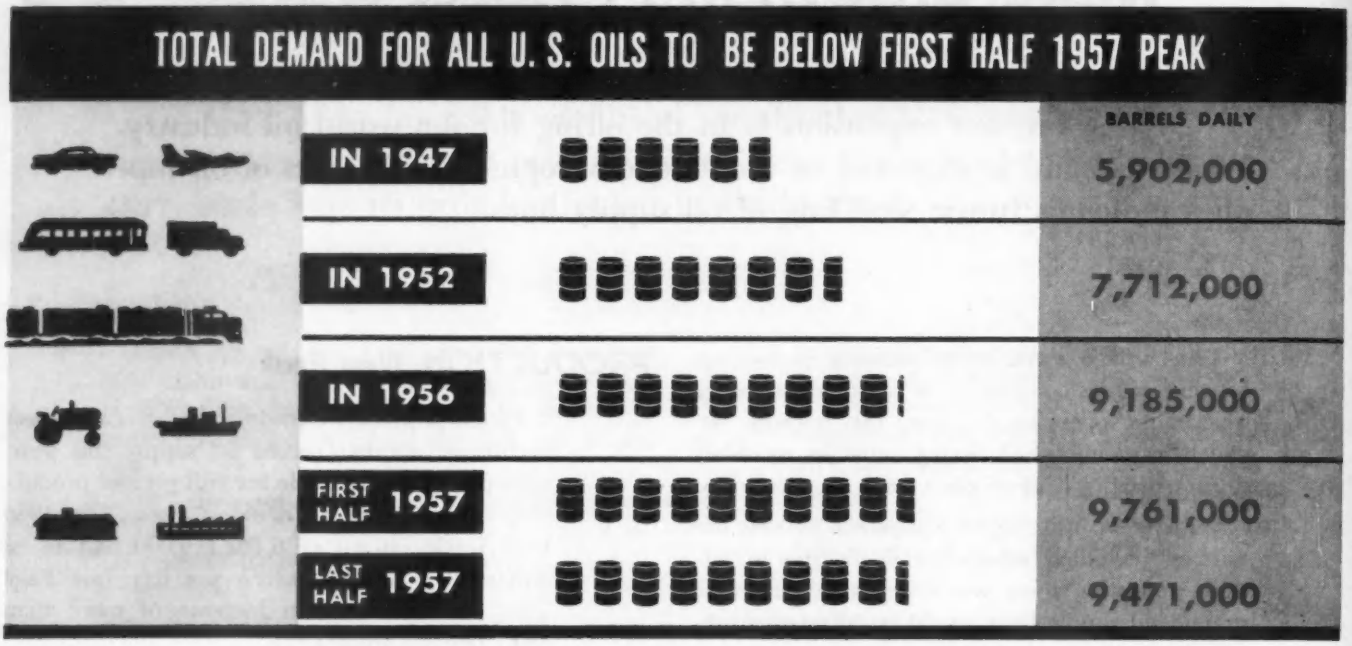
RESERVES: *Record Level*

The outlook for even greater crude reserves in 1958 is bright. Considering the development initially under way in areas of proved potentiality and the programs announced for that development's continuation, prospects are that the record reserves as of Jan. 1, 1957 (see Page 197) of almost 207.5 billion barrels would be enhanced next year, perhaps by a significant margin.

The continuing upturn in the discovery rate of new supplies of crude oil was reflected in the almost 11 percent jump in proved crude reserves in 1956 from the previous year.

DRILLING: *Large Growth*

Prospects are that by the close of 1957 increased drilling rates outside the U. S. will have led to the completion of 9431 wells for the year. That amounts to a 10 percent-plus increase from 1956. Even higher drilling rates are anticipated in view of the recent discoveries of new oil in various areas of the world.



4.7% Gain Over '56 Due in U. S. Demand

Normal growth forecast after wide fluctuations in first half.

TOTAL DEMAND for all oils to be supplied by the U. S. petroleum industry in 1957 will average about 9,615,000 barrels daily, it is estimated. That is an increase of 430,000 barrels daily or 4.7 percent over 1956.

It is a normal gain. But demand has been varying widely from last year's trends, as shown in a table herewith. The changes from 1956 have been caused by several factors. Especially important was the abnormally large export demand in the early months of 1957. Exports of crude and fuel oils were unusually heavy in that period in supplying emergency needs of Western Europe. The oils were needed in lieu of cut-off shipments from the Middle East, during closure of the Suez Canal.

First Quarter. Total demand for all oils in this year's first three months averaged about 10,607,000 barrels daily, an increase of 844,000 barrels or 8.6 percent over 1956.

In the second quarter of 1957 the shipments to Europe diminished sharply. At the same time, U. S. domestic consumption fell below expectations. In both May and June total demand, export and domestic, was only about the same as in 1956. For the second quarter as a whole, total demand averaged 9,019,000 barrels daily, up 293,000 barrels or 3.4 percent over 1956.

First Half Up 5.6 Percent. The net result of the booming first quarter and the letdown in the second quarter was first half 1957 total demand of 9,761,000 barrels daily. That was 516,000 barrels a day or 5.6 percent more than the demand in the initial half of 1956.

The emergency shipments to Europe were largely responsible for that increase. Domestic demand alone in the first six months of 1957 showed an increase of only about 1.5 percent over the like period of 1956.

Outlook at Mid-Year. At the middle of 1957 the demand for petroleum continued relatively weak, with exports down sharply and domestic consumption lacking in vigor.

The industry was hopeful that the vacation season would generate heavy sales of gasoline. On the basis of those hopes, it is here estimated that total demand for oils in the third quarter will average about 8,874,000 barrels daily, an increase of 360,000 barrels or 4.2 percent over 1956.

Requirements for oils in the fourth quarter will depend greatly upon the weather. Use of heating oil may vary a great deal from last year's consumption if the weather is colder or warmer. If it is assumed that the weather this year will be about normal, total demand for petroleum in the fourth quarter may be expected to average about 10,068,000 barrels

daily. That would be an increase of 329,000 barrels or 3.4 percent over demand in the final quarter of 1956.

On the basis of the above estimates of demand in the third and fourth quarters, the total demand for petroleum in the second half of 1957 would average 9,471,000 barrels daily. It would be up 344,000 barrels or 3.8 percent from 1956.

Too Much Supply. The irregular trends of demand for oils in 1957 have required unusual changes in volumes of supply. It has been difficult to keep supply and demand in balance. In the early months of 1957 it was hard to provide enough supply to meet the emergency European requirements. Subsequently, it has been difficult to reduce supply in proportion to the shrinkage of demand.

U. S. crude production hit a peak in March. State conservation agencies then cut allowables repeatedly in April, May, June and July, and continued strict curtailment in August. Crude runs to stills at refineries have been similarly held down. And steps are being taken to hold U. S. petroleum imports down to reasonable levels.

The net result has been a fairly satisfactory situation with regard to stocks of crude oil and refined products.

It was generally recognized that inventories would have to be watched carefully to avoid surpluses that might weaken markets for oils.

U. S. Stocks of Major Refined Products At Mid-Year (End of June), 1956 and 1957, by Refining Districts

(Sources: 1956 from Bureau of Mines; 1957 from A.P.I.)

(Thousands of Barrels)

	GASOLINE			KEROSINE			DISTILLATE FUEL OIL			RESIDUAL FUEL OIL		
DISTRICT	1956	1957	Percent Diff.	1956	1957	Percent Diff.	1956	1957	Percent Diff.	1956	1957	Percent Diff.
East Coast	39,691	42,352	+ 6.7	10,162	11,183	+10.0	27,463	40,162	+46.2	9,661	11,246	+16.4
Appalachian No. 1	4,350	5,014	+15.3	457	544	+19.0	1,779	2,403	+35.1	338	482	+42.6
Appalachian No. 2	2,853	2,589	— 9.3	627	496	—20.9	679	809	+19.1	249	272	+ 9.2
Ind., Ill., Ky.	31,850	33,139	+ 4.0	4,901	5,340	+ 9.0	13,096	17,542	+33.9	4,370	5,847	+33.8
Minn., Wis., N. & S.D.	6,374	6,183	— 3.0	929	963	+ 3.7	4,790	5,270	+10.0	217	403	+85.7
Okla., Kans., Mo.	15,472	16,492	+ 6.6	1,321	1,485	+12.4	9,940	10,811	+ 8.8	1,093	985	— 9.9
Inland Texas	6,852	7,221	+ 5.4	370	387	+ 4.6	1,720	2,277	+32.4	1,477	1,832	+24.0
Texas Gulf Coast	24,880	25,465	+ 2.4	3,721	3,434	— 7.7	13,784	14,122	+ 2.5	5,838	6,188	+ 6.0
La. Gulf Coast	10,170	10,832	+ 6.5	2,387	3,080	+29.0	6,097	6,252	+ 2.5	1,777	1,539	—13.4
N. La. & Ark.	4,207	4,176	— 0.7	456	823	+80.5	1,743	1,826	+ 4.8	161	101	—37.3
New Mexico	441	375	—15.0	14	10	—28.6	124	78	—37.1	48	66	+37.5
Other Rocky Mt.	6,748	7,115	+ 5.4	373	254	—31.9	2,656	2,926	+10.2	935	1,166	+24.7
West Coast	23,188	26,454	+14.1	393	378	— 3.8	9,887	12,488	+26.3	12,909	15,215	+17.9
Total U.S.	177,076	187,407	+ 5.8	26,111	28,377	+ 8.7	93,758	116,966	+24.8	39,073	45,342	+16.0

TOTAL DOMESTIC AND EXPORT DEMAND FOR U. S. OILS

(Thousands of barrels daily)

	1957	1956	Percent Change
January	11,386	10,065	+13.1
February	10,407	9,714	+ 7.1
March	10,023	9,506	+ 5.4
April	9,414	8,838	+ 6.5
May	8,605	8,603	+—
June	8,750	8,741	+ 0.1
First Half	9,761	9,245	+ 5.6

	1957	1956	Percent Change
First Quarter	10,612	9,763	+ 8.7
Second Quarter	8,920	8,726	+ 2.2
Forecast:			
Third Quarter	8,874	8,514	+ 4.2
Fourth Quarter	10,068	9,739	+ 3.4
Second Half	9,471	9,127	+ 3.8
Total Year	9,615	9,185	+ 4.7

U. S. Crude Oil Stocks, by Grades, at Mid-Year, 1956 and 1957

(THOUSANDS OF BARRELS)

GRADE	June 30, 1956	June 29, 1957	Change
Pennsylvania Grade	2,665	2,812	+ 147
Other Appalachian	2,395	1,749	— 646
Lima-Michigan	716	825	+ 109
Illinois-Indiana	10,970	9,033	—1,937
Arkansas	2,937	2,748	— 189
Kansas	8,938	10,896	+1,958
Nebraska-North Dakota	2,340	2,568	+ 228
Louisiana	15,440	18,249	+2,809
North Louisiana	2,490	2,727	+ 237
Gulf Louisiana	12,950	15,522	+2,572
Mississippi, Alabama & Florida	2,878	3,110	+ 232
New Mexico	7,284	7,615	+ 331
Oklahoma	25,922	21,700	—4,222
Texas	123,056	128,858	+5,802
East Texas Proper	9,311	11,613	+2,302
West Texas	60,093	60,555	+ 462
Gulf Coast	21,518	24,579	+3,061

GRADE	June 30, 1956	June 29, 1957	Change
Other Texas	32,134	32,111	— 23
Panhandle	3,206	2,842	— 364
North Texas	9,051	8,309	— 742
South Texas	4,957	5,061	+ 104
Rest of Texas	14,920	15,899	+ 979
Wyoming	19,013	17,868	—1,145
Other Rocky Mountain	7,187	6,030	—1,157
California	28,523	27,702	— 821
Total Domestic	260,264	261,763	+1,499
Foreign	14,413	15,520	+1,107
In California	3,540	2,876	— 664
Other Foreign	10,873	12,644	+1,771
Total in United States	274,677	277,283	+2,606

Source: U.S. Bureau of Mines.

U. S. CRUDE PRODUCTION SHOWS BIG INCREASE IN FIRST HALF OF 1957

BARRELS DAILY

1947	5,088,000
1952	6,256,000
1956	7,151,000
1957 First Half	7,516,600

. . . Output 50 Percent Larger Than 10 Years Ago

U. S. Crude Production . . . If imports plan works, look for some increases.

Hopes of U. S. crude oil producers for relief from excessive supplies rest primarily upon the government's voluntary import curb (See Page 127). If the program is successful in reducing U. S. imports, some increase in U. S. crude producing rates can be anticipated during the closing months of the year.

Under the import program a U. S. daily average production of 7,217,000 barrels during the second half of 1957 has been forecast by the U. S. Office of Oil and Gas, Department of Interior. Without the import curb, the Oil and Gas Office estimated second half U. S. crude production would average but 7,002,000 barrels daily. Therefore, the Oil and Gas Office sees the import program as increasing second half 1957 U. S. crude production by 215,000 barrels daily.

An increase of this size would be welcome relief to U. S. producers, who have been forced to drastically curtail production since reopening of the Suez Canal. July crude oil production averaged slightly less than 7 million barrels daily, and August will be at the same level.

Most of the increase must necessarily take place in the fourth quarter of 1957. The import curb was not promulgated until the last day of July. Because of previously scheduled tanker sailings it will be several months before there can be any noticeable reduction in imports.

Under these circumstances it would appear that U. S. crude production will show only little change until October, then increase appreciably in November and December when the import curb should be fully effective if it is to be successful.

Anticipated second half production of 7,217,000 barrels daily would still be considerably below the 7,516,600 barrels produced during the first half of 1957. Such a second half producing level would result in a daily average production of 7,365,000 barrels during the full year 1957, compared with 7,151,000 barrels in 1956.

However, there is still considerable uncertainty as to how successful the voluntary import restriction program will be. If the program is not fully successful, U. S. production is not likely to reach the volume forecast.

Sharp Fluctuations. Although U. S. crude production is accustomed to sharp, sudden rises and reductions, the first half of 1957 saw producing rates undergo larger than normal fluctuations.

Due to increased export demand resulting from the Suez Canal blockade disrupting Middle East shipments to Western Europe, production rose sharply during early months of 1957. An all-time high daily average of 7,717,000 barrels was reached in March, far more than October, 1956, average of just under 7 million barrels per day. Despite high producing rates, over 11 million barrels of crude were supplied from inventories during the first quarter of the year.

With the reopening of the Suez Canal came a sudden surplus of crude oil. Export demand fell sharply, and imports increased at an equally sharp

DAILY AVERAGE PRODUCTION FIRST HALF 1957

Texas produces three times more than any other state

TEXAS	3,191,300
CALIFORNIA	932,000
LOUISIANA	966,000
OKLAHOMA	619,200
KANSAS	334,000
WYOMING	295,200
NEW MEXICO	264,400
ILLINOIS	213,700
21 OTHERS	700,800

U. S. Crude Oil Production, by States and Districts, June and First Half of Year, 1956 and 1957

From U. S. Bureau of Mines except May and June, 1957, from A.P.I. weekly reports, and breakdown of Texas by Districts from A.P.I.
(THOUSANDS OF BARRELS)

State or District	JUNE Total 1956	JUNE Total 1957	JUNE % Diff.	JUNE Daily Average 1956	JUNE Daily Average 1957	FIRST HALF OF YEAR Total 1956	FIRST HALF OF YEAR Total 1957	FIRST HALF OF YEAR Daily Average 1956	FIRST HALF OF YEAR Daily Average 1957	FIRST HALF OF YEAR % Diff.	% of U.S. in 1956
Alabama	257	369	+ 43.6	8.6	12.3	1,125	2,282	6.2	12.6	+103.2	0.2
Arkansas	2,382	2,577	+ 8.2	79.4	85.9	14,225	15,541	78.2	85.9	+ 9.8	1.2
California	28,845	27,785	— 3.7	961.5	926.2	175,935	168,692	966.7	932.0	— 3.6	12.4
Colorado	4,927	4,497	— 8.7	164.2	149.9	29,545	28,166	162.3	155.6	— 4.1	2.1
Florida	39	40	+ 2.6	1.3	1.3	244	228	1.3	1.3	.....	0.0
Illinois	6,692	5,528	— 17.4	223.1	184.2	41,043	38,681	225.5	213.7	— 5.2	2.8
Indiana	940	880	— 6.4	31.3	29.3	5,294	6,250	29.1	34.5	+ 18.6	0.4
Kansas	10,345	10,314	— 0.3	344.8	343.8	62,110	60,446	341.3	334.0	— 2.1	4.4
Kentucky	1,444	1,264	— 12.5	48.1	42.1	8,729	8,317	48.0	46.0	— 4.2	0.6
Louisiana	24,124	26,380	+ 9.4	804.1	879.3	146,888	174,848	807.2	966.0	+ 19.7	12.9
North Louisiana	3,886	4,042	+ 4.0	129.5	134.7	23,152	24,785	127.2	137.0	+ 7.7	1.8
South Louisiana	20,238	22,338	+ 10.4	674.6	744.6	123,736	150,063	680.0	829.0	+ 21.9	11.1
Michigan	869	837	— 3.7	29.0	27.9	5,529	5,126	30.4	28.3	— 6.9	0.4
Mississippi	3,310	3,451	+ 4.3	110.3	115.0	20,118	20,713	110.5	114.4	+ 3.5	1.5
Montana	1,770	2,206	+ 24.6	59.0	73.5	10,277	13,005	56.5	71.9	+ 27.3	1.0
Nebraska	1,349	1,546	+ 14.6	45.0	51.5	7,650	9,184	42.0	50.7	+ 20.1	0.7
Nevada	6	3	— 50.0	0.2	0.1	37	16	0.2	0.1	— 50.0	0.0
New Mexico	7,025	7,753	+ 10.4	234.2	258.4	43,343	47,861	238.2	264.4	+ 11.0	3.5
Southeast New Mexico	6,915	7,630	+ 10.3	230.5	254.3	42,736	46,899	234.8	259.1	+ 10.3	3.4
Northwest N. Mexico	110	123	+ 11.8	3.7	4.1	607	962	3.4	5.3	+ 55.9	0.1
New York	226	231	+ 2.2	7.5	7.7	1,370	1,352	7.5	7.5	.....	0.1
North Dakota	1,086	1,129	+ 4.0	36.2	37.6	6,536	6,995	35.9	38.6	+ 7.5	0.5
Ohio	381	430	+ 12.9	12.7	14.3	2,295	2,530	12.6	14.0	+ 11.1	0.2
Oklahoma	17,392	17,412	+ 0.1	579.8	580.4	108,981	112,068	598.9	619.2	+ 3.4	8.2
Pennsylvania	704	719	+ 2.1	23.5	24.0	4,074	4,167	22.4	23.0	+ 2.7	0.3
Texas*	89,853	92,407	+ 2.8	2,995.1	3,080.2	554,706	577,631	3,048.1	3,191.3	+ 4.7	42.5
Dist. 1: South Central	1,635	1,615	— 1.2	54.5	53.8	9,742	10,186	53.5	56.3	+ 5.2	0.8
Dist. 2: Middle Gulf	4,585	4,525	— 1.3	152.8	150.8	28,870	28,900	158.6	159.7	+ 0.7	2.1
Dist. 3: Upper Gulf	13,518	13,726	+ 1.5	450.6	457.5	82,773	84,510	454.8	466.9	+ 2.7	6.2
Dist. 4: L. Gulf-S.W.	7,099	6,994	— 1.5	236.6	233.1	44,812	44,077	246.2	243.5	— 1.1	3.2
Dist. 5: East Central	1,332	1,199	— 10.0	44.4	40.0	8,379	7,523	46.0	41.6	— 9.6	0.6
Dist. 6: Northeast	9,885	10,157	+ 2.8	329.5	338.6	63,243	64,136	347.5	354.3	+ 2.0	4.7
Dist. 7-B: N. Central	4,593	4,977	+ 8.4	153.1	165.9	28,367	30,204	155.9	166.9	+ 7.1	2.2
Dist. 7-C: W. Central	5,629	4,935	— 12.3	187.6	164.5	33,612	31,300	184.7	172.9	— 6.4	2.3
Dist. 8: West	31,083	34,821	+ 12.0	1,036.1	1,160.7	189,722	214,170	1,042.5	1,183.3	+ 13.5	15.7
Dist. 9: North	6,484	6,379	— 1.6	216.1	212.6	38,088	38,771	209.3	214.2	+ 2.3	2.9
Dist. 10: Panhandle	2,855	3,079	+ 7.8	95.2	102.6	17,104	18,961	94.0	104.8	+ 11.5	1.4
Utah	123	249	+102.4	4.1	8.3	901	1,841	5.0	10.2	+104.0	0.1
Virginia	1	3	+200.0	.....	0.1	5	8	.....	.....	.....	0.0
West Virginia	185	182	— 1.6	6.2	6.1	1,097	1,078	6.0	6.0	.....	0.1
Wyoming	8,712	8,741	+ 0.3	290.4	291.4	52,062	53,439	286.1	295.2	+ 3.2	3.9
Others†	10	3	— 70.0	0.3	0.1	52	47	0.3	0.3	.....	0.0
Total U. S.	212,997	216,936	+ 1.8	7,099.9	7,231.2	1,304,171	1,360,512	7,166.5	7,516.6	+ 4.9	100.0

* Data for Texas in first half of year by districts are from A.P.I. and do not agree with Texas Total, which is from Bureau of Mines except May and June, 1957 from A.P.I.

† Includes Missouri, South Dakota and Tennessee.

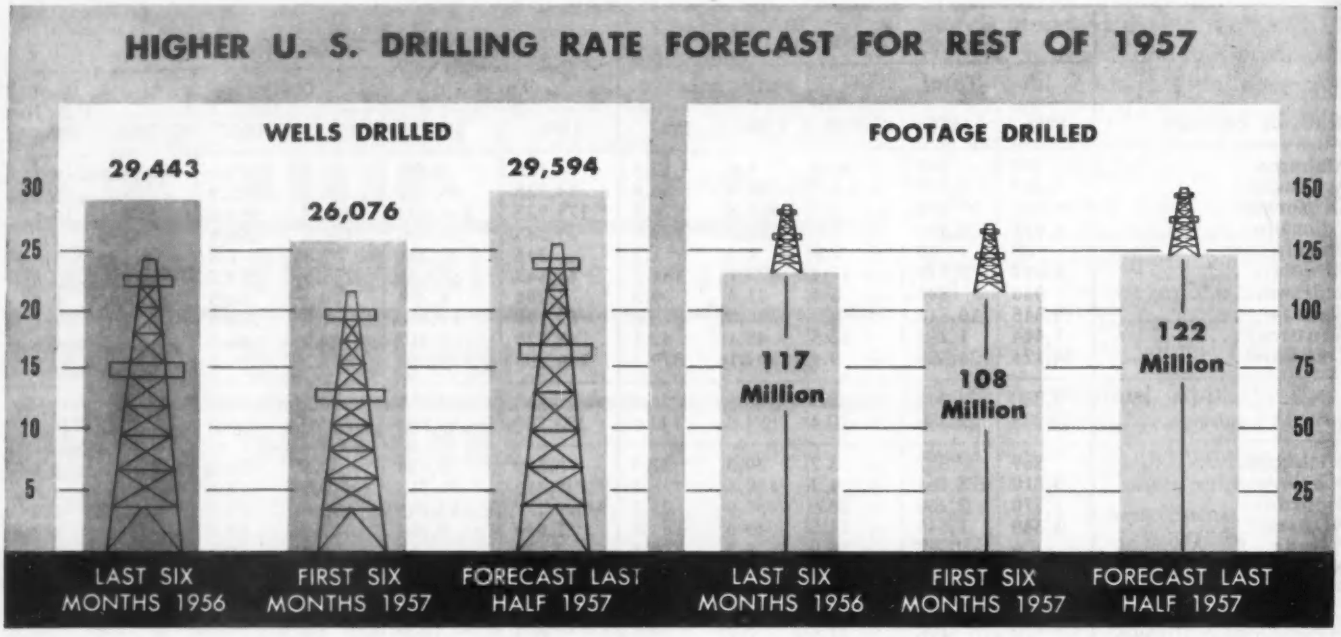
rate. Crude stocks immediately began increasing, and by mid-year were 24 million barrels greater than at the end of March. It was necessary to curtail U. S. production. Output was cut back month by month from the March peak until U. S. production averaged a little under 7 million barrels per day in July. Prorated wells in Texas were producing only 13 days a month.

The reduced July level returned U. S. production to pre-Suez volumes, and slightly below July, 1956 quantities.

The biggest increase occurred in Louisiana, and assisted by a decrease in California output, the state became the nation's second largest producer during the first half of 1957. Louisiana was quick to react to the increased demand that followed the closing of the Suez Canal. Production was increased from 796,000 barrels daily in October to a peak of 1,103,500 barrels in March. The surplus crude supply which developed as soon as the Suez Canal was reopened, resulted in Louisiana's production being curtailed to 879,000 barrels daily by June, but this was still 75,000 barrels higher than in June, 1956.

Second largest gain was in Texas, where production averaged 3,191,300 barrels daily during the first half of the year. This was 143,200 barrels more per day than produced in 1956.

Texas' production advanced from 2,932,500 barrels daily in November, 1956, to a new peak of 3,324,400 barrels in March, 1957. Even at its highest rate, prorated wells in the state were producing only 18 days per month. Drastic curtailment followed reopening of the Suez Canal, and by July, Texas was producing less than 3 million barrels per day with prorated wells limited to 13 days monthly.



Big Gain Forecast for U. S. Drilling

Completion of 13.5 percent more wells and 12.5 percent more footage in last half of 1957 than in first six months is forecast by WORLD OIL.

By WARREN L. BAKER, Editorial Director
and **CECIL W. SMITH,** Statistical Editor, WORLD OIL

A LARGE INCREASE in U. S. drilling rates is in prospect for the second half of 1957. WORLD OIL's annual mid-year survey of oil company drilling plans indicates the U. S. drilling slump is coming to an end.

Drilling rates are expected to equal the high volumes which existed in the last half of both 1956 and 1955.

On the basis of its mid-year survey of oil company drilling plans, WORLD OIL forecasts the drilling of 29,594 wells and 122.2 million feet of hole in the U. S. in the last six months of 1957.

A big increase will be necessary to fulfill this forecast. Completion of 29,594 wells would represent an increase of 3518 wells (13.5 percent) over the 26,076 wells completed during the first six months of 1957.

Such a completion rate would be slightly higher than the 29,443 wells drilled in the corresponding period of 1956, and only slightly below the record of 29,839 completions made in the last six months of 1955.

The 122.2 million feet of hole forecast for the final six months of 1957 is a gain of 13.6 million feet (12.5 percent) over the 108.5 million feet drilled the first half of 1957.

Such a volume would be 7.2 million more feet of hole (3.7 percent) than drilled the second half of 1956, and just slightly less than the 122.5 million feet drilled the final six months of 1955.

Practically every state is expected to see greater drilling activity than in the first half of 1957. However, gains in many states will not fully offset first half decreases, and therefore will complete fewer wells in the year than in 1956.

The full year will see less drilling than in 1956. Despite the anticipated

Summary of U. S. Drilling Prospects

	New Well Completions	Footage Drilled	New Producing Completions
Twelve Months:			
1957 Forecast	55,670	230,709,300	33,700
1956	58,418	235,386,709	35,136
1955	55,879	228,529,688	34,643
1957-1956 Change	—4.7%	—2.0%	—4.1%
1957-1955 Change	—0.4%	+1.0%	—2.7%
Second Six Months:			
1957 Forecast	29,594	122,177,868	17,793
1956	29,443	117,811,048	17,603
1955	29,839	122,491,913	18,222
1957-1956 Change	+0.5%	+3.7%	+1.1%
1957-1955 Change	—0.8%	—0.3%	—2.4%
First Six Months:			
1957	26,076	108,531,432	15,907
1956	28,975	117,575,661	17,533
1955	26,040	106,037,775	16,421
1957-1956 Change	—10.0%	—7.7%	—9.3%
1957-1955 Change	+0.1%	+2.4%	—3.1%

Footage and Average Depths Drilled in All Wells in the United States, First Half of 1957

STATE or DISTRICT	TOTAL NEW WELLS								WILDCAT WELLS		
	First Half 1957			First Half 1956			Percent Change 1957-1956		Drilled First Half 1957	Drilled First Half 1956	Percent Change 1957-1956
	Wells	Footage	Average Depth	Wells	Footage	Average Depth	Wells	Footage			
Alabama	62	544,737	8786	46	355,954	7738	+ 34.8	+ 53.0	22	16	+ 37.5
Arizona	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas	507	1,503,967	2966	407	1,285,802	3159	+ 24.6	+ 17.0	73	70	+ 4.3
California	1,089	4,691,790	4308	1,061	4,948,644	4664	+ 2.6	— 5.2	181	122	+ 48.4
Colorado	402	2,096,170	5214	651	3,421,102	5255	— 38.3	— 38.7	246	311	— 21.0
Florida	6	40,312	6719	6	35,002	5834	.....	+ 15.2	6	6	.....
Illinois	1,187	2,655,090	2237	1,786	4,194,120	2348	— 33.5	— 36.7	354	463	— 23.6
Indiana	323	507,302	1571	303	524,398	1731	+ 6.6	— 3.3	87	80	+ 8.8
Kansas	2,023	7,206,396	3562	2,363	8,340,112	3529	— 14.4	— 13.6	478	616	— 22.4
Kentucky	744	1,114,985	1499	857	1,237,578	1442	— 13.2	— 9.9	59	70	— 15.7
Louisiana	1,790	14,867,058	8306	1,780	13,340,016	7494	+ 0.6	+ 11.4	289	291	— 0.7
North Louisiana	622	2,321,280	3732	710	2,574,641	3626	— 12.4	— 9.9	77	90	— 14.5
South Louisiana	1,168	12,545,778	10741	1,070	10,765,375	10061	+ 9.2	+ 16.5	212	201	+ 5.5
Michigan	192	551,416	2872	235	664,202	2826	— 77.6	— 17.0	80	75	+ 6.7
Mississippi	178	1,212,851	6814	210	1,537,253	7320	— 15.2	— 21.1	95	82	+ 15.9
Missouri	1	370	370	17	18,095	1064	— 4.1	— 98.0	2	11	— 81.8
Montana	178	957,469	5379	195	1,001,198	5134	— 8.7	— 4.4	55	63	— 12.7
Nebraska	423	2,499,749	5910	512	2,928,492	5720	— 17.4	— 14.7	220	253	— 13.1
New Mexico	1,116	5,092,215	4563	947	4,313,410	4555	+ 17.8	+ 18.1	146	119	+ 22.7
New York	231	394,100	1706	197	277,200	1407	+ 17.3	+ 42.2	.....	.....	.....
North Dakota	132	920,677	6975	139	1,073,481	7723	— 5.0	— 14.2	56	40	+ 40.0
Ohio	469	1,151,762	2456	499	1,227,359	2532	— 6.0	— 6.2	3	3	.....
Oklahoma	2,809	10,272,372	3657	4,120	14,833,743	3600	— 31.8	— 30.8	314	431	— 27.2
Pennsylvania	448	1,289,086	2877	392	1,107,266	2825	+ 14.3	+ 16.4	25	.....	.....
South Dakota	25	95,533	3821	4	28,436	7109	+750.0	+336.0	24	4	+600.0
Texas	11,011	46,022,793	4180	11,292	47,410,810	4199	— 2.5	— 2.9	2,556	2,699	— 5.3
Dist. 1 South Central	696	1,743,345	2505	1,049	2,837,755	2705	— 33.7	— 38.6	196	259	— 24.3
Dist. 2 Middle Gulf	363	2,276,055	6270	427	2,657,683	6224	— 15.0	— 14.4	131	137	— 4.4
Dist. 3 Upper Gulf	876	5,933,451	6773	887	5,898,440	6646	— 1.3	+ 0.6	235	227	+ 3.5
Dist. 4 Lower Gulf-S.W.	720	3,807,170	5288	744	3,926,074	5271	— 3.2	— 3.0	224	235	— 4.7
Dist. 5 & 6 East Central and Northeast	624	3,336,091	5346	571	2,766,367	4845	+ 9.3	+ 20.6	184	190	— 3.2
Dist. 7-b & 9 North Central and North	3,891	11,132,973	2861	4,286	13,580,593	3169	— 9.2	— 18.0	1,071	1,168	— 8.3
Dist. 7-C & 8 West Central and West	3,142	15,027,018	4783	2,660	13,216,794	4969	+ 18.1	+ 13.7	452	403	+ 12.2
Dist. 10 Panhandle	699	2,766,690	3958	668	2,527,104	4969	+ 4.6	+ 9.5	63	56	+ 12.5
Utah	92	541,169	5882	72	338,641	4703	+ 27.8	+ 59.3	47	51	— 7.9
West Virginia	284	778,738	2742	350	921,950	2634	— 18.9	— 15.5	10	.....	.....
Wyoming	344	1,473,976	4285	444	2,080,138	4685	— 22.5	— 29.2	106	113	— 6.2
Other States*	10	49,349	4668	9	62,472	6872	+ 25.0	— 21.1	10	7	.....
Total United States	26,076	108,531,432	4162	28,894	117,506,874	4067	— 9.8	— 7.7	5,544	5,996	— 7.5

STATE or DISTRICT	OIL			DISTILLATE			GAS			DRY			SERVICE WELLS		
	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth
Alabama	40	458,776	11469	.....	.....	.....	1	1,641	1641	21	84,320	4015	.....	.....	.....
Arizona	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Arkansas	339	918,754	2710	.....	.....	.....	11	49,186	4471	157	536,027	3414	.....	.....	.....
California	772	3,154,293	4086	.....	.....	.....	26	138,737	5336	290	1,391,760	4799	1	7000	7000
Colorado	63	359,330	5704	.....	.....	.....	44	233,641	5310	295	1,503,199	5096	.....	.....	.....
Florida	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	40,312	6719	.....	.....	.....
Illinois	469	1,046,008	2230	.....	.....	.....	10	8,225	823	707	1,598,839	2261	1	2018	2018
Indiana	109	186,214	1708	.....	.....	.....	13	10,616	817	201	310,472	1545	.....	.....	.....
Kansas	893	2,999,251	3359	.....	.....	.....	186	739,905	3978	897	3,371,665	3759	47	95,575	2034
Kentucky	248	283,629	1144	.....	.....	.....	101	224,408	2222	387	596,920	1542	8	10,028	1254
Louisiana	932	7,160,415	7683	101	1,230,139	12180	124	1,149,814	9273	633	5,326,690	8415	.....	.....	.....
North Louisiana	351	1,053,706	3002	3	32,942	10981	45	224,794	4995	223	1,009,838	4528	.....	.....	.....
South Louisiana	581	6,106,709	10511	98	1,197,197	12216	79	925,020	11709	410	4,316,852	10529	.....	.....	.....
Michigan	77	244,648	3177	.....	.....	.....	2	7,122	3561	113	299,646	2652	.....	.....	.....
Mississippi	60	467,142	7786	2	19,705	9853	3	22,319	7440	113	703,685	6227	.....	.....	.....
Missouri	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	370	370	.....	.....	.....
Montana	93	565,684	6083	.....	.....	.....	3	8,998	2999	82	382,787	4668	.....	.....	.....
Nebraska	138	860,873	6238	.....	.....	.....	2	6,642	3321	283	1,632,234	5768	.....	.....	.....
New Mexico	605	2,888,622	4775	3	22,325	7442	281	1,175,100	4182	227	1,006,168	4432	.....	.....	.....
New York	118	155,970	1322	.....	.....	.....	18	57,600	3200	18	63,000	3500	77	117,530	1526
North Dakota	74	616,577	8332	.....	.....	.....	.....	.....	.....	58	304,100	5243	.....	.....	.....
Ohio	276	691,824	2507	.....	.....	.....	94	258,590	2751	99	201,348	2034	.....	.....	.....
Oklahoma	1,666	6,027,316	3618	19	136,477	7183	118	629,880	5338	922	3,247,980	3523	84	230,719	2747
Pennsylvania	142	226,172	1593	.....	.....	.....	128	635,246	4963	36	205,868	5719	142	221,800	1562
South Dakota	.....	.....	.....	.....	.....	.....	.....	.....	.....	25	95,533	3821	.....	.....	.....
Texas	6,443	26,093,064	4050	193	1,645,465	8526	414	2,191,177	5293	3,828	18,819,386	4133	133	273,701	2058
Dist. 1: South Central	400	819,820	2050	8	67,984	8498	8	72,036	9005	278	778,035	2799	2	5,470	2735
Dist. 2: Middle Gulf	95	564,954	5947	42	363,934	8665	51	265,064	5197	175	1,082,103	6183	.....	.....	.....
Dist. 3: Upper Gulf	405	2,357,381	5821	57	533,971	9368	39	294,161	7543	375	2,747,938	7328	.....	.....	.....
Dist. 4: Lower Gulf-S.W.	259	1,242,677	4798	56	442,178	7896	67	361,389	5394	338	1,760,926	5210	.....	.....	.....
Dist. 5 & 6: East Central and Northeast	315	1,163,587	3694	14	101,491	7249	43	264,691	6156	252	1,338,322	5311	.....	.....	.....
Dist. 7-B & 9 North Central and North	2,001	5,900,820	2949	5	29,597	5919	52	257,617	4954	1,727	4,739,637	2744	106	205,302	1937
Dist. 7-C & 8: West Central and West	2,469	11,738,713	4754	1	8,500	8500	48	299,129	6232	599	2,917,747	4871	25	62,929	2517
Dist. 10: Panhandle	499	1,837,112	3682	10	97,810	9781	106	377,090	3557	84	454,678	5413	.....	.....	.....
Utah	40	234,886	5872	.....	.....	.....	3	19,591	6530	49	286,692	5851	.....	.....	.....
West Virginia	44	87,438	1987	5	18,982	3796	185	519,871	2810	50	152,447	3049	.....	.....	.....
Wyoming	163	669,388	4107	.....	.....	.....	13	80,562	6197	167	720,719	4316	1	3,307	3307
Other States*	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	49,349	4935	.....	.....	.....
Total United States	13,804	56,396,274	4086	323	3,073,093	9514	1,780	8,168,871	4589	9,675	39,931,516	4127	494	961,678	1947

* Georgia, Idaho, Maryland, Nevada, Oregon, Tennessee, Virginia and Washington.

Forecast of U. S. Wells and Footage to Be Drilled in Last Six Months 1957 and in Year 1957

Forecast covers all new wells to be drilled for oil or gas in 1957, salt water disposal wells, and water or gas-input wells for repressuring and secondary recovery but does not estimate old wells drilled deeper.

STATE or DISTRICT	Forecast For Last Six Months 1957		Forecast For 12 Months 1957		Percent Change: Last Half 1957—First Half 1957		Percent Change: Year 1957 and Year 1956		Percent of U.S. Year 1957	
	Total New Wells	Footage of Total New Wells	Total New Wells	Footage of Total New Wells	Total Wells	Footage	Total Wells	Footage	Total Wells	Footage
Alabama	43	377,763	105	922,500	— 30.7	— 30.7	+ 16.7	+ 19.9	0.18	0.40
Arizona	5	16,000	5	16,000	.....	.....	— 28.6	— 27.4	0.01	.....
Arkansas	638	1,891,633	1,145	3,395,600	+ 25.8	+ 25.8	+ 11.7	+ 11.1	2.06	1.47
California	1,161	5,001,610	2,250	9,693,400	+ 6.6	+ 6.6	+ 2.2	— 3.4	4.04	4.19
Colorado	508	2,648,830	910	4,745,000	+ 26.4	+ 26.4	— 28.1	— 27.1	1.64	2.05
Florida	4	26,888	10	67,200	— 33.3	— 33.3	— 28.6	— 29.1	0.01	0.03
Illinois	1,393	3,113,310	2,580	5,768,400	+ 17.4	+ 17.3	— 29.3	— 31.4	4.64	2.50
Indiana	407	638,998	730	1,146,300	+ 26.0	+ 26.0	+ 3.3	— 6.9	1.31	0.50
Kansas	2,337	8,343,104	4,360	15,549,500	+ 15.5	+ 15.8	— 6.1	— 5.5	7.83	6.74
Kentucky	916	1,374,015	1,660	2,489,000	+ 23.1	+ 23.2	— 17.4	— 17.3	2.98	1.08
Louisiana	2,095	17,028,542	3,885	31,895,600	+ 17.0	+ 14.5	+ 2.2	+ 14.0	6.98	13.82
North Louisiana	783	2,924,520	1,405	5,245,800	+ 25.9	+ 30.0	— 14.9	— 12.4	2.53	2.27
South Louisiana	1,312	14,104,022	2,480	26,649,800	+ 12.3	+ 12.4	+ 15.2	+ 21.2	4.45	11.55
[1] Gulf of Mexico	362	3,399,195	710	6,669,800	+ 4.0	+ 3.9	+ 59.2	+ 56.4	1.28	2.89
Michigan	238	683,084	430	1,234,500	+ 24.0	+ 23.9	— 1.8	— 2.7	0.77	0.54
Mississippi	247	1,682,149	425	2,895,000	+ 38.8	+ 38.7	— 2.3	— 8.0	0.77	1.25
Missouri	4	2,030	5	2,400	+400.0	+448.6	— 80.0	— 91.2	0.01	.....
Montana	262	1,410,831	440	2,368,300	+ 47.2	+ 47.4	— 12.5	— 4.9	0.79	1.03
Nebraska	552	3,267,851	975	5,767,600	+ 30.5	+ 30.7	+ 9.8	+ 12.0	1.75	2.50
New Mexico	1,204	5,496,285	2,320	10,588,500	+ 7.9	+ 7.9	+ 17.9	+ 21.1	4.17	4.59
New York	274	468,600	505	862,700	+ 18.6	+ 18.9	+ 2.6	+ 12.3	0.90	0.37
North Dakota	153	1,066,323	285	1,987,000	+ 15.9	+ 15.8	+ 1.8	— 4.4	0.51	0.86
Ohio	511	1,254,538	980	2,406,300	+ 9.0	+ 8.9	— 4.5	— 2.3	1.77	1.05
Oklahoma	3,251	11,898,628	6,060	22,171,000	+ 15.7	+ 15.9	— 20.7	— 18.3	10.88	9.61
Pennsylvania	612	1,407,614	1,060	2,696,700	+ 36.6	+ 9.2	+ 1.2	+ 10.2	1.90	1.17
South Dakota	15	57,467	40	153,000	— 40.0	— 39.9	+ 90.5	+115.0	0.08	0.06
Texas	11,749	48,928,407	22,760	94,951,200	+ 6.7	+ 6.3	+ 1.8	— 0.1	40.88	41.16
Dist. 1: South Central	859	2,147,455	1,555	3,890,800	+ 23.4	+ 23.2	— 22.0	— 23.5	2.79	1.69
Dist. 2: Middle Gulf	407	2,553,945	770	4,830,000	+ 12.1	+ 12.2	— 5.4	— 3.5	1.38	2.09
Dist. 3: Upper Gulf	879	5,950,849	1,755	11,884,300	+ 0.3	+ 0.3	— 4.0	— 5.3	3.16	5.15
Dist. 4: L. Gulf-S.W.	745	3,941,030	1,465	7,748,200	+ 3.5	+ 3.5	+ 1.0	+ 2.4	2.63	3.36
Dists. 5 & 6: East	661	3,536,409	1,285	6,872,500	+ 5.9	+ 6.0	+ 6.6	+ 13.8	2.31	2.98
Dists. 7-B & 9: North	4,059	11,608,727	7,950	22,741,700	+ 4.3	+ 4.3	— 1.6	— 9.7	14.28	9.86
Dists. 7-C & 8: West	3,418	16,337,982	6,560	31,365,000	+ 8.8	+ 8.7	+ 17.3	+ 11.7	11.78	13.59
Dist. 10 Panhandle	721	2,852,010	1,420	5,618,700	+ 3.1	+ 3.1	+ 1.6	+ 1.5	2.55	2.44
Utah	163	959,331	255	1,600,500	+ 77.2	+ 77.3	+ 74.7	+130.5	0.46	0.65
West Virginia	351	962,462	635	1,741,200	+ 23.6	+ 23.6	— 9.0	— 8.5	1.14	0.75
Wyoming	461	1,975,424	805	3,449,400	+ 34.0	+ 34.0	— 16.5	— 16.4	1.45	1.50
Other States*	40	196,151	50	245,500	+420.0	+455.2	— 29.6	— 20.0	0.09	0.11
Total United States	29,594	122,177,868	55,670	230,709,300	+ 13.5	+ 12.5	— 4.7	— 2.0	100.00	100.00

* Other States include Georgia, Idaho, Nevada, Maryland, North Carolina, Oregon, Tennessee, Virginia and Washington.
[1] Gulf of Mexico wells are included in South Louisiana figures.

big increase for the last six months, reduced drilling in the first half will leave the U. S. behind 1956 in both wells and footage.

The predicted high second half activity would result in 55,670 new wells for the U. S. during all 1957. This would be 4.7 percent less than the 58,418 wells completed (a revised figure) in 1956. However, completions would be almost the same as the 55,879 wells drilled in 1955.

The first half slump saw the completion of only 26,076 wells, 10.0 percent under the 28,975 wells drilled in the corresponding period of 1956. Footage dropped to 108.5 million feet in the first half of 1957, or 7.7 percent below the 117.5 million feet drilled in the same period of 1956, but 2.4 percent above 1955 rates.

The decrease was surprising in view of record producing levels and higher prices during the first half of the year. The U. S. produced 56 million barrels more oil in the first half of 1957 than in 1956. Crude oil prices advanced in January. These developments normally mean increased activity, drilling rates traditionally following the volume and value of production.

Chief factors responsible for the failure of drilling to respond to higher production and prices were: (1) failure of higher crude prices to fully compensate for rising costs, especially when both wages and materials rose further in 1957; and (2) fear of rising imports reaching such levels higher crude prices could not be maintained.

Bad winter and spring weather over a large portion of the country also contributed to reduced first half drilling. Storms and high water delayed considerable drilling. Tight money contributed to the reduction, but was not an important factor.

More New U. S. Producing Completions

Increased second half drilling activity should boost number of new producing completions to 17,793, or 1886 over first half.

INCREASED DRILLING activity forecast for the U. S. (see Page 122) presages a sharp rise in completion of new producing wells during the second half of 1957.

On the basis of past operations, prospective second half drilling rates indicate a total of 17,793 new producing wells are likely to be completed in the U. S. during the final six months of the year. This would compare with the completion of 15,907 new producing completions in the first half of the year. About 15,466 new producing oil wells and 2327 new gas or distillate producing wells are likely, in contrast with 13,804 oil wells and 2103 gas-distillate wells in the first six months of 1957.

The forecast for productive completions during the rest of 1957 would result in the completion of 33,700 new producing wells during the full 12 months of the year, of which 29,270 would be oil wells and 4430 gas and distillate wells. During 1956, a total of 35,136 new producing wells were completed, of which 30,641 produced oil and 4495 produced gas and distillate.

Each of these newly-completed producing wells will need to be equipped with wellheads, flow lines and other production facilities. Many of the oil wells will require lifting equipment immediately.

Texas will lead in productive completions. The forecast for Texas is completion of 7520 new producing wells, compared with 7050 in the first six months of the year. Therefore,

Forecast of New U. S. Productive Well Completions in Second Half of 1957 and Year 1957

STATE or DISTRICT	SECOND HALF 1957 FORECAST			FIRST HALF 1957 ACTUAL			FORECAST YEAR 1957			1956 ACTUAL
	New Oil Wells	New Gas and Distillate Wells	Total Productive Wells	New Oil Wells	New Gas and Distillate Wells	Total Productive Wells	New Oil Wells	New Gas and Distillate Wells	Total Productive Wells	Total Productive Wells
Alabama	28	1	**29**	40	1	**41**	68	2	**70**	**54**
Arizona	.....	.....	.....	.....	.....	.....	.....	.....	.....	**2**
Arkansas	426	14	**440**	339	11	**350**	765	25	**790**	**681**
California	823	29	**852**	772	26	**798**	1,595	55	**1,650**	**1,702**
Colorado	77	56	**133**	63	44	**107**	140	100	**240**	**357**
Illinois	551	10	**561**	469	10	**479**	1,020	20	**1,040**	**1,659**
Indiana	136	17	**153**	109	13	**122**	245	30	**275**	**267**
Kansas	1,032	214	**1,246**	893	186	**1,079**	1,925	400	**2,325**	**2,478**
Kentucky	337	109	**446**	248	101	**349**	585	210	**795**	**990**
Louisiana	1,093	260	**1,353**	932	225	**1,157**	2,025	485	**2,510**	**2,404**
North Louisiana	439	62	**501**	351	48	**399**	790	110	**900**	**1,098**
South Louisiana	654	198	**852**	581	177	**758**	1,235	375	**1,610**	**1,306**
Gulf of Mexico[1]	220	43	**263**	210	42	**252**	430	85	**515**	**252**
Michigan	93	3	**96**	77	2	**79**	170	5	**175**	**218**
Mississippi	85	5	**90**	60	5	**65**	145	10	**155**	**142**
Missouri	.....	.....	.....	.....	.....	.....	.....	.....	.....	**5**
Montana	132	2	**134**	93	3	**96**	225	5	**230**	**241**
Nebraska	177	3	**180**	138	2	**140**	315	5	**320**	**297**
New Mexico	655	306	**961**	605	284	**889**	1,260	590	**1,850**	**1,569**
New York	142	12	**154**	118	18	**136**	260	30	**290**	**292**
North Dakota	86	.....	**86**	74	.....	**74**	160	.....	**160**	**179**
Ohio	254	101	**355**	276	94	**370**	530	195	**725**	**744**
Oklahoma	1,924	153	**2,077**	1,666	137	**1,803**	3,590	290	**3,880**	**4,975**
Pennsylvania	198	132	**330**	142	128	**270**	340	260	**600**	**615**
Texas	6,877	643	**7,520**	6,443	607	**7,050**	13,320	1,250	**14,570**	**14,091**
Dist. 1: S. Central	495	19	**514**	400	16	**416**	895	35	**930**	**1,214**
Dist. 2: Middle Gulf	105	102	**207**	95	93	**188**	200	195	**395**	**446**
Dist. 3: Upper Gulf	405	99	**504**	405	96	**501**	810	195	**1,005**	**1,067**
Dist. 4: L. Gulf-S.W.	256	127	**383**	259	123	**382**	515	250	**765**	**785**
Dists. 5 & 6: East	335	58	**393**	315	57	**372**	650	115	**765**	**638**
Dists. 7-B & 9: North	2,084	63	**2,147**	2,001	57	**2,058**	4,085	120	**4,205**	**4,227**
Dists. 7-C & 8: West	2,681	56	**2,737**	2,469	49	**2,518**	5,150	105	**5,255**	**4,487**
Dist. 10: Panhandle	516	119	**635**	499	116	**615**	1,015	235	**1,250**	**1,227**
Utah	70	2	**72**	40	3	**43**	110	5	**115**	**59**
West Virginia	56	230	**286**	44	190	**234**	100	420	**520**	**584**
Wyoming	212	17	**229**	163	13	**176**	375	30	**405**	**513**
Other States*	2	8	**10**	.....	.....	.....	2	8	**10**	**18**
Total United States	15,466	2,327	**17,793**	13,804	2,103	**15,907**	29,270	4,430	**33,700**	**35,136**

[1] Gulf of Mexico wells are included in South Louisiana figures.
* Other States include Georgia, Idaho, Maryland, Nevada, Oregon, Tennessee, Virginia and Washington.

Texas is expected to drill 14,570 new producing wells during the year, in contrast with 14,091 during 1956.

The West Texas and West Central Texas district will lead with 5255 new producing completions for the year, in contrast with 4487 last year. More than half of this district's total are expected in the last six months of 1957.

New producing completions in North Texas are expected to total 4205 for the year, practically the same as in 1956. More new productive wells will be completed in West Texas and North Texas than in any state.

Sizable increases are expected in South Louisiana and New Mexico. Over the whole year, the completion of 1610 new producing wells is forecast for South Louisiana in contrast with 1306 during 1956. Included in the South Louisiana total are an estimated 515 new offshore producing wells, compared with 252 last year.

New producing completions in New Mexico are expected to rise to 1850 in 1957, against 1569 during 1956.

Big declines are anticipated for Oklahoma, Illinois, Kansas and Colorado. Only 3880 new producing completions are forecast for Oklahoma this year, in comparison with 4975 last year. Illinois' new productive wells are seen as declining to 1040 in contrast with 1659 during 1956.

A total of 2325 new producing wells is forecast for Kansas, where 2478 were completed last year. Colorado is seen as falling from 357 new productive completions in 1956 to 240 during 1957.

Fewer Wildcats Are Forecast

Anticipated second half increase will not fully offset first half decline, resulting in 804 fewer wildcat completions for '57.

THE PRESSURE of reduced U. S. producing allowables and rising costs is more than offsetting the favorable influence of higher crude oil prices. The result is reduced U. S. wildcatting.

Greater U. S. wildcat activity is promised for the second half of 1957 than in the first six months of the year. However, there will be fewer wildcats completed during 1957 as a whole than in 1956 because of reduced first half activity.

WORLD OIL forecasts that 6226 wildcats will be drilled in the last six months of 1957. This would be 683 more than the 5243 wildcats completed in the first half of 1957.

Therefore, total wildcats for the year 1957 are expected to total 11,770 in contrast with 12,574 in 1956.

Almost every state is expected to experience more wildcatting in the last half of the year than in the first half. Nevertheless, practically every state is likely to have fewer wildcats for the year 1957 than in 1956.

WORLD OIL's forecast predicts that Arkansas, California, Michigan, Utah and North Dakota will be the only important states which will have more wildcatting in 1957 than in 1956.

As usual, Texas should account for nearly half of the nation's wildcats. A total of 2754 Texas wildcats is forecast for the last half of 1957, compared with 2556 in the first half. This would give Texas a total of 5310 wildcats for the year, against 5546 last year.

West Texas is the only state district expected to have greater wildcatting activity than in 1956. A total of 950 wildcats is forecast for West Texas in 1957. This region completed 855 wildcats in 1956.

Almost half of Texas' wildcats are forecast for North Texas. The prediction is for 1114 wildcats during the last six months of 1957, and a total of 2185 for the year.

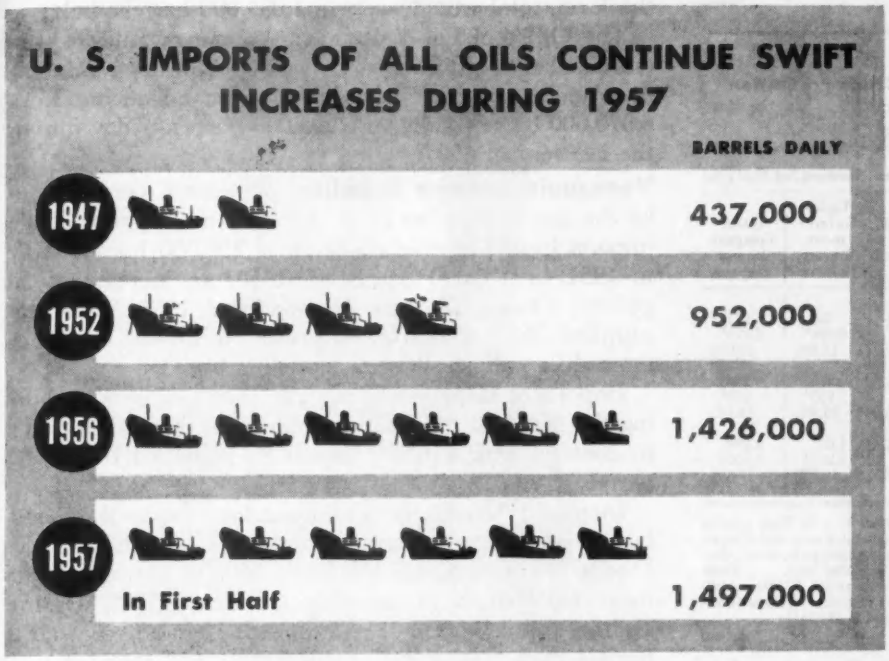
Increased Louisiana offshore wildcatting is forecast. A total of 105 wildcats is predicted for 1957, compared with 70 in 1956. However, this will not offset reduced wildcatting in other parts of the state. Louisiana as a whole is expected to complete 625 wildcats in 1957. The record for 1956 was 678 wildcats.

Forecast of U. S. Wildcat Tests to Be Drilled Last Six Months 1957 and in Year 1957

STATE or DISTRICT	FORECAST		DRILLED	
	Last Six Months 1957	12 Months 1957	First Six Months 1957	12 Months 1956
Alabama	13	35	22	27
Arizona	5	5	...	7
Arkansas	92	165	73	151
California	164	345	181	293
Colorado	274	520	246	695
Florida	4	10	6	14
Illinois	366	720	354	959
Indiana	103	190	87	184
Kansas	587	1,065	478	1,213
Kentucky	71	130	59	140
Louisiana	336	625	289	678
North Louisiana	98	175	77	230
South Louisiana	238	450	212	448
† Gulf of Mexico	65	105	40	70
Michigan	90	170	80	159
Mississippi	115	210	95	205
Missouri	4	5	1	16
Montana	95	150	55	207
Nebraska	270	490	220	427
New Mexico	164	310	146	284
North Dakota	69	125	56	84
Ohio	5	8	3	3
Oklahoma	356	670	314	814
Pennsylvania	10	35	25	9
South Dakota	15	39	24	20
Texas	2,754	5,310	2,556	5,546
Dist. 1: South Central	244	440	196	575
Dist. 2: Middle Gulf	144	275	131	277
Dist. 3: Upper Gulf	235	470	235	489
Dist. 4: Lower Gulf-S.W.	241	465	224	506
Dist. 5 & 6: East	201	385	184	382
Dist. 7-B & 9: North	1,114	2,185	1,071	2,322
Dist. 7-C & 8: West	498	950	452	855
Dist. 10: Panhandle	77	140	63	140
Utah	83	130	47	92
West Virginia	12	22	10	31
Wyoming	134	240	106	272
Other States*	36	46	10	44
Total United States	6,227	11,770	5,543	12,574

† Gulf of Mexico wells included with South Louisiana.

* Georgia, Idaho, Maryland, Nevada, Oregon, Tennessee, Virginia and Washington.



U. S. Imports . . . Government calls for voluntary 20% cut to give U. S. producers relief.

INCREASING U. S. crude oil imports, long protested by the nation's independent producers, are due to be cut back in the near future under a U. S. government voluntary program. This important development is designed to provide relief for U. S. producers from excessive crude supplies. The U. S. government's voluntary program, inaugurated at the end of July, asks importing companies to reduce imports in the second half of 1957 nearly 20 percent below previously scheduled volumes. If fully successful, crude oil imports in the second half of 1957 will average 1,031,000 barrels daily under the government formula, in contrast with 1,266,000 barrels according to importing companies schedules previously filed with the Office of Defense Mobilization.

The government import program calls for established importing companies to reduce their crude oil imports into all areas except the West Coast by 10 percent from their three-year average for 1954, 1955 and 1956. The government did not ask for any reduction on West Coast crude imports, nor on imports of refined products in any part of the country. Furthermore, importers of less than 20,000 barrels daily in 1954 were not asked to cut below 1957 import schedules filed with the Office of Defense Mobilization.

Imports of 1,031,000 barrels of crude during the rest of 1957 would be below recent months, but still be above earlier years. U. S. crude imports in 1956 averaged 934,000 barrels per day, and in 1955 averaged 782,000 barrels daily. Crude imports in recent months, however, have been averaging 1,250,000 barrels per day. Therefore, the program can bring relief to U. S. producers if it is successful in curbing import rates.

Refined product imports also have been increasing. During the first half of 1957 they averaged 562,000 barrels per day, compared with 492,000 barrels for the year 1956, and 466,000 barrels in 1955.

Consequently, total U. S. imports (crude and refined products combined) have risen sharply in recent years. They averaged 1,497,000 barrels per day in the first half of 1957 despite the retarding influence of the Suez Canal blockage, in contrast with 1,426,300 barrels in the year 1956, and 1,248,000 barrels daily in 1955. By July, 1957, total U. S. imports averaged 1,600,000 barrels daily.

Effect on East Coast. The aim of the government program is to reduce crude oil imports east of the Rocky Mountains to 756,000 barrels daily during the second half of 1957, in contrast with company schedules for importing 971,000 barrels into this area. With West Coast crude imports estimated at 275,000 barrels per day,

Destination of U. S. Crude Oil Imports by U. S. Districts 1952-1956

	THOUSANDS OF BARRELS ANNUALLY					% Gain
	1952	1953	1954	1955	1956	1952–1956
District 1 (East Coast)	192,349	202,611	213,413	232,850	244,453	27.1%
District 2 (North Central)	1,116	2,562	2,772	7,425	19,904	1683.6%
District 3 (Gulf Coast)	4,423	2,871	4,553	11,098	11,917	169.4%
District 4 (Rocky Mountain)	.....	.....	.....	.....	70	.....
District 5 (West Coast)	11,703	28,411	18,741	34,048	65,489	459.6%

Source: U. S. Bureau of Mines.

Forecast of Crude Oil Imports Ratio to U. S. Crude Production Under Government Program

Figures in Thousands of Barrels Daily

	Year 1954	Year 1955	Pre-Suez Third Quarter 1956	Post Suez 4 Weeks Ended July 26, 1957	Forecast 2nd Half 1957 Under Government Import Program	Forecast 2nd Half 1957 Under Company Import Program
Districts I-IV:						
Imports	605	689	830	940‡	756	971
Production	5,367	5,835	6,155	5,995	6,294*	6,079*
Ratio	11.3%	11.8%	13.5%	15.7%	12.0%	16.0%
District V:						
Imports	51	93	212	364‡	275†	296†
Production	975	972	959	931	923*	923*
Ratio	5.2%	9.6%	22.1%	39.1%	29.8%	32.1%
Total U. S.:						
Imports	656	782	1,042	1,304‡	1,031	1,266
Production	6,342	6,807	7,114	6,926	7,217†	7,002†
Ratio	10.3%	11.5%	14.7%	19.0%	12.0%	17 8%

* Estimated by Office of Oil and Gas, Department of Interior. † In filing reports with the Office of Defense Mobilization, importing companies estimated imports into District V for this period would be 296,000 barrels daily. There is reason to believe, however, that these imports will not exceed 275,000 barrels daily, and this figure is used here. ‡ From American Petroleum Institute weekly reports, to which have been added 57,000 barrels daily to cover unreported receipts by military and other government agencies. This is necessary to make API figures comparable with other import figures used in the table.

U. S. Government Crude Oil Import Program for Districts I-IV (Outside West Coast)

(In Thousands of Barrels Daily)

	1954	1955	1956	3 Year Average	PROGRAMMED LAST HALF 1957 By Companies	PROGRAMMED LAST HALF 1957 Per Formula
Established Importers:						
Atlantic	62.7	64.1	69.4	65.4	75.7	58.9
Gulf	117.9	125.2	129.0	124.0	153.0	111.6
Sinclair	65.1	68.8	73.5	69.1	74.6	62.2
Socony	87.2	71.5	65.0	74.6	78.9	67.1
Standard of California	70.6	76.7	75.3	74.2	86.0	66.8
Jersey Standard	80.7	79.4	79.9	80.0	87.0	72.0
Texaco	52.2	65.1	64.2	60.5	74.9	54.5
Total	536.4	550.8	556.3	547.8	630.1	493.1
New Importers:						
Cities Service	11.3	29.2	25.8	....	32.6	32.6
Eastern States	4.3	17.2	18.6	....	18.3	18.3
Gabriel	....	....	5.7	....	7.5	7.5
Great Northern(*)	....	6.0	21.1	....	33.0	33.0
International Ref.(*)	2.0	2.0	9.2	....	10.9	10.9
Lakehead (*)	....	....	0.3	....	0.3	0.3
Lake Superior (*)	2.0	2.0	5.0	....	5.0	5.0
Northwestern	....	2.0	6.0	....	10.0	10.0
Phillips	7.0	10.6	11.1	....	12.0	12.0
Shell (*)	....	.5	.8	....	7.5	7.5
Indiana Standard	15.5	15.0	17.8	....	49.4	29.8
Ohio Standard	....	0.7	1.9	....	8.2	8.2
Sun	15.1	24.4	38.4	....	58.4	50.4
Tidewater	5.1	12.9	22.2	....	84.6	34.2
Southwestern	1.5	5.6	2.1	....	2.9	2.9
Total	63.8	128.1	186.0	....	340.6	262.6
Miscellaneous	4.8	10.1	12.7	....	....	....
Total Districts I-IV	605.0	689.0	755.0	....	a/970.7	b/755.7

(*)Importer of Canadian crude. a/District I-IV production required 6,079. b/District I-IV production required 6,294.

West Coast Crude Oil Imports

(In Thousands of Barrels Daily)

	1954	1955	1956	3 Year Average	PROGRAMMED LAST HALF 1957 By Companies	PROGRAMMED LAST HALF 1957 Per Formula
Douglas	....	1.6	1.0	0.9	N. R.	N. R.
Socony (General Pet.)	3.5	26.4	32.5	20.8	26.5	26.5
California Standard	21.0	17.7	22.1	20.3	68.0	68.0
Shell	....	6.6	28.1	11.6	56.9	56.9
Texaco	10.6	9.4	21.9	14.0	19.0	19.0
Tidewater	13.7	25.0	43.1	27.3	53.0	53.0
Union	....	....	11.7	3.9	24.5	24.5
U. S. Oil Refining	....	....	....	....	7.5	7.5
Richfield	....	....	1.5	0.5	16.6	16.6
Wilshire	....	....	12.2	4.0	24.0	24.0
Other (to bal.)	2.2	6.3	4.9	4.4	....	....
Total	51.0	93.0	179.0	107.7	296.0(*)	296.0(*)

(*)There is reason to believe that the total imports for this period will not exceed 275,000 b/d.

the U. S. total would average 1,031,000 barrels daily.

The Office of Oil & Gas, Department of Interior, has estimated reduced imports east of the Rockies will result in crude oil production in this region advancing from 6,079,000 barrels daily to 6,294,000 barrels a day during the last half of 1957.

Venezuela Largest Supplier. Venezuela continues to be the largest supplier of U. S. crude oil imports. Crude imports from Venezuela rose from 294,000 barrels daily in 1951 to 456,000 barrels in 1956, an increase of 55 percent. During the first six months of 1957, Venezuela supplied 552,000 barrels of crude oil to the U. S., or more than half of all U. S. crude imports.

Imports of Canadian crude also increased sharply during the first half of 1957, averaging 163,000 barrels daily in contrast with 116,800 barrels in 1956 and only 1300 barrels in 1951.

Increased Venezuela and Canadian crude shipments largely offset the decline in imports of Middle East crude. Due to the Suez Canal blockade, Middle East shipments decreased sharply in the early months of 1957. During February and March they dropped to just over 30,000 barrels daily. However, by June they had risen to new all-time peaks of 317,000 barrels daily.

Large Residual Imports. Much of the U. S. imports of refined products consist of residual fuel oils. Refined product imports in 1956 averaged 492,400 barrels daily, of which 442,000 barrels or nearly 90 percent was residual fuel oil. Imports of residual fuel oil from Venezuela averaged 400,000 barrels per day in 1956.

Sources of U. S. Crude Oil Imports by Months in 1957

(Thousands of Barrels Daily)

	SOUTH AMERICA Venezuela	SOUTH AMERICA Others	NORTH AMERICA Canada	NORTH AMERICA Mexico	MIDDLE EAST Kuwait	MIDDLE EAST Saudi Arabia	MIDDLE EAST Others	FAR EAST Sumatra	Total Crude Imports
1957:									
January	477.3	28.2	148.0	13.3	47.4	10.1	8.8	35.4	804.5
February	520.5	20.1	169.2	9.3	30.2	.....	2.1	29.0	780.4
March	556.0	27.7	171.1	7.2	14.4	.....	19.9	39.3	835.6
April	570.4	16.2	179.4	7.1	86.3	4.9	14.2	27.9	906.4
May	605.3	16.2	167.3	3.7	84.9	.....	94.7	38.0	1,010.1
June	581.4	16.1	107.4	.....	125.8	51.1	139.0	44.6	1,065.4
Six Months	552.1	20.8	163.2	6.7	65.0	16.5	46.9	35.8	901.4

Source: U.S. Bureau of Mines, except May and June, 1957, from Texas Railroad Commission, whose data appears incomplete. API reported crude imports for the two months to be: 1,028,000 and 1,173,000 barrels daily.

Sources of U. S. Crude Oil Imports 1951-1956

ORIGIN	THOUSANDS OF BARRELS DAILY 1951	1955	1956	Percent Gain 1951-1956	PERCENT OF TOTAL 1951	1956
South America	339.0	413.2	485.2	43.1%	69.1%	52.0%
Venezuela	294.3	385.6	456.4	55.1%	60.0%	48.9%
Others	44.7	27.6	28.8	—35.6%	9.1%	3.1%
North America	39.3	61.2	129.5	229.5%	8.0%	13.9%
Canada	1.3	46.1	116.8	8984.6%	0.3%	12.5%
Mexico	38.0	15.1	12.7	—66.6%	7.7%	1.4%
Middle East	102.7	274.9	282.8	175.4%	20.9%	30.3%
Kuwait	59.2	134.1	139.2	135.1%	12.0%	14.9%
Saudi Arabia	43.5	79.6	75.6	73.8%	8.9%	8.1%
Others	.....	61.2	68.0	.....	.....	7.3%
Far East	9.6	32.7	36.4	279.2%	2.0%	3.8%
Total	490.6	782.0	933.9	90.4%	100.0%	100.0%

Types of U. S. Refined Oil Products Imports, 1951-1956

Residual Fuel	326.5	416.5	442.2	35.4%	95.0%	89.8%
Other Products	17.2	49.6	50.2	191.9%	5.0%	10.2%
Total	343.7	466.1	492.4	43.6%	100.0%	100.0%

Source: Bureau of Mines.

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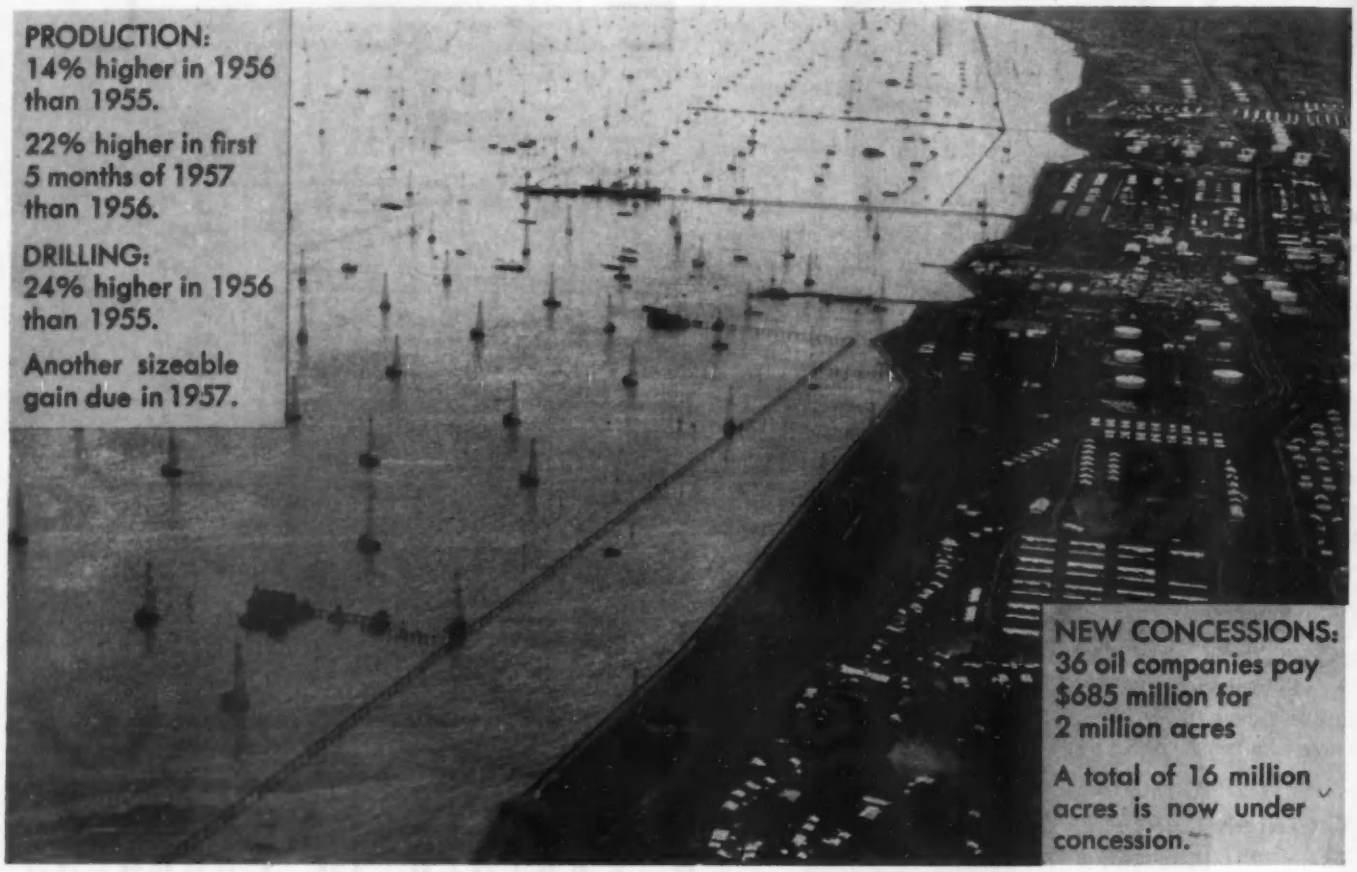

PRODUCTION:
14% higher in 1956 than 1955.
22% higher in first 5 months of 1957 than 1956.
DRILLING:
24% higher in 1956 than 1955.
Another sizeable gain due in 1957.
NEW CONCESSIONS:
36 oil companies pay $685 million for 2 million acres
A total of 16 million acres is now under concession.

Aerial view of Lake Maracaibo oil fields. There are some 3000 wells in the lake.

Venezuela Oil Enters Vastly Bigger Era

Granting of first new petroleum concessions since 1945 greatly enlarges number of operating companies, presaging increased activity which will enable Venezuela to maintain the high production expansion rates experienced in recent years.

By WARREN L. BAKER, Editorial Director, WORLD OIL

VENEZUELA'S OIL industry continues to undergo extremely rapid growth, and further high rates of expansion are in prospect for coming years.

Bright prospects for additional production gains presage the continuation of Venezuela's ranking as the second largest oil producing country and the largest oil exporting nation in the world for many years.

The upward march in Venezuela's producing rate has been steady and substantial for many years, but it has increased at a faster pace during the past few years. In March, April and May, 1957, Venezuela's production was almost half a million barrels daily, or 18 percent above the daily average for 1956. This was three-fourths of a million barrels per day or one-third larger than 1955's daily average, more than 1 million barrels per day or 50 percent more than just five years ago, and 1¾ million barrels a day or 2½ times greater than ten years ago. None of the amazing Middle East oil producing countries surpasses this rate of production increase.

Despite higher oil producing rates, proved crude reserves have risen by substantial amounts. Only the reserves of the U. S. and the gigantic reserves of a few leading Middle East nations exceed those of Venezuela.

Natural gas production, utilization and reserves also have advanced to record volumes. Tremendous progress in the conservation of natural gas is writing a new chapter in the oil industry's history.

Along with these developments it is natural that Venezuela's drilling activity has experienced sharp growth. One-fourth more wells were completed in 1956 than in the previous year, and new peaks are indicated for the future.

However, the really big recent Venezuela development has been the granting of the first new oil concessions since 1945. New concessions were granted on 2 million acres. Concession sales were featured by the successful bids of a number of U. S. companies

not heretofore active in Venezuela, and by the high prices paid for some concessions near production in Lake Maracaibo.

Outlook Exceptionally Bright. Granting of new concessions, coupled with the entry of additional companies, rising production and a high ratio of successful discoveries, indicate increased oil activity for Venezuela in the near future. If future discovery rates are anywhere near past high ratios, all phases of Venezuela's oil industry will undergo additional great growth in the immediate future.

In attempting to look at Venezuela's future, it is impossible to overlook other equally significant factors. Venezuela's economy today is one of the strongest in the world. It has one of the few hard metal currencies left in the world. All national debts have been paid off and a surplus exists, a rarity among nations today.

Venezuela's economy is growing at one of the fastest rates in history. The government is using its income, 70 percent of which comes from oil, to strengthen the country's economy and to push a vast program for public improvements. Recent years have seen more than 50 percent of the government's gross budget spent for schools, medical clinics, roads, hospitals, irrigation, sanitation, housing and other public improvements. The result is phenomenal progress.

Venezuela stands today as an example of the unparalleled progress that can be achieved by under-developed areas, when private capital is encouraged to develop natural resources and the government wisely spends its share of the income for the benefit of its people (see "Wise Use of Oil Income Gives Venezuela Bright Outlook," Page 177, WORLD OIL, July, 1957).

Granting of new concessions during the past year once more demonstrates Venezuela's faith in private enterprise. The large amount of acreage bid in by the oil companies—and some of the prices paid—demonstrates the faith of private capital when it has an opportunity to work with an enlightened, understanding, stable government.

All these conditions indicate Venezuela is on the threshold of a new era which will see it make swift and gigantic progress. Additional rapid expansion of the country's oil industry will play a significant part in Venezuela's future development.

New Concessions Mean Greater Expansion

One of the most important long-term oil developments in recent years was the granting of the first new oil concessions in Venezuela since 1945. The event brought many new companies into Venezuela and added substantial funds to the Government's treasury.

This should lead to greater Venezuelan oil activity, which undoubtedly will result in the discovery of additional oil reserves and in increased production. Thus, Venezuela can be expected to maintain its distinction as the second largest oil producing country and as the largest exporting nation in the world. This means an adequate supply of oil in the Western Hemisphere to meet expanding future demand.

Concessions on Two Million Acres. Since July 4, 1956, at total of 36 companies, including partnership interests, paid $685 million for slightly more than 2 million acres of new concessions.

This raised the amount of concessions in Venezuela to slightly over 16 million acres, an increase of 14.5 percent. The oil basins of Venezuela contain approximately 100 million acres, so concessions now cover 16 percent of the probable favorable petroleum area.

Thirty-six exploitation and national reserve concessions covered 768,351 acres, about one-third of the total. However, these concessions brought bids of almost $630 million, while exploration rights on 1¼ million acres brought only $55½ million.

Many New Companies Enter Venezuela. An important result of the new concessions granted in Venezuela was the entry of many new companies. Interests in the new concessions included 36 companies, of which 33 were American, two Canadian and one British-Dutch. American companies paid about $600 million of the $685 million paid for new concessions.

An important result was the granting of concessions to groups and inter-

Summary of New Petroleum Concessions Granted in Venezuela
(Includes all awards between July 4, 1956 and August 1, 1957)

LOCATION	Number of Concessions	Type of Concession	Number of Acres	Total Price (U.S. Dollars)*	Dollars per Acre (Average)
Lake Maracaibo	12	Exploitation	307,479.21	$334,896,583.73	$ 1,089.17
	7	National Reserves	42,695.22	84,754,267.66	1,985.10
	19		350,174.43	419,650,851.39	1,198.41
Gulf of Paria	9	Exploitation	218,206.60	124,894,333.99	572.37
Barinas	1	Exploitation	27,865.12	21,937,232.04	787.26
	13	Exploration	300,325.34	22,773,462.77	75.83
	14		328,190.46	44,710,694.81	136.23
Zulia	11	Exploration	240,897.79	4,809,789.63	19.97
Apure	21	Exploration	523,852.00	10,291,262.12	19.64
Monagas	7	Exploitation	172,105.16	63,208,463.73	367.27
Monagas-Sucre	3	Exploration	72,449.72	15,229,320.39	210.21
Tachira	4	Exploration	98,840.00	1,941,747.56	19.64
Tachira-Zulia	1	Exploration	24,710.00	485,436.89	19.64
Total Exploitation	**29**	.....	**725,656.09**	**544,936,613.49**	**750.96**
Total National Reserve	**7**	.....	**42,695.22**	**84,754,267.66**	**1,985.10**
Total Exploration	**53**	.....	**1,261,074.85**	**55,531,019.44**	**44.03**
GRAND TOTAL	**89**	.....	**2,029,426.16**	**685,221,900.59**	**337.64**

* Bolivares converted to U. S. dollars at 3.09.

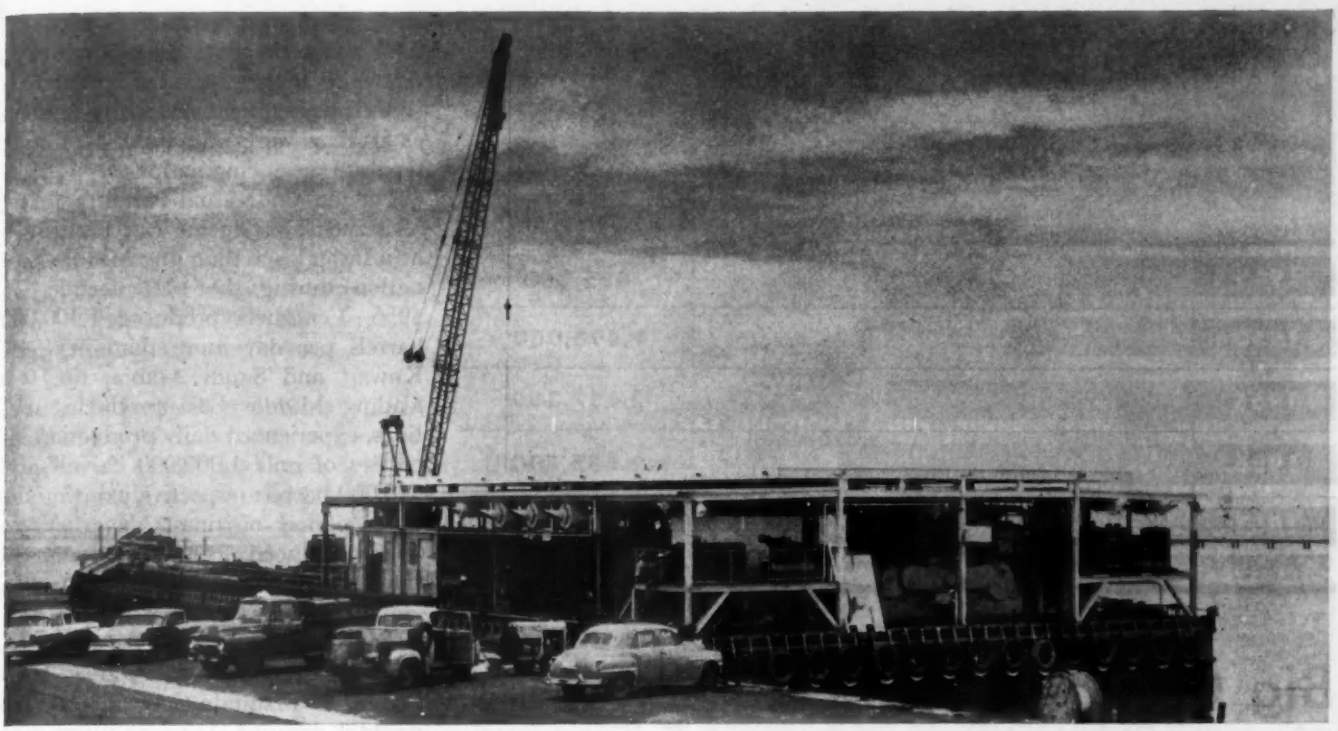
New Petroleum Concessions Granted in Venezuela, by Companies

(Includes all awards between July 4, 1956, and August 1, 1957)

COMPANY (Names in **Heavy Type** indicate Company is a New Venezuela Operator.)	Number of Concessions	Type of Concession	Location	No. of Acres	Total Price* (U. S. Dollars)	Dollar Per Acre
Mene Grande Oil Company; International Petroleum Co.; and Compania Shell de Venezuela	2	Exploitation	Lake Maracaibo	49,420.00	$ 56,000,000.00	$1,133.15
	1	Exploitation	Lake Maracaibo	24,680.27	17,183,238.83	696.23
	1	Exploitation	Lake Maracaibo	32,060.66	32,382,912.61	1,010.03
	1	National Reserve	Lake Maracaibo	9,986.77	9,287,443.37	930.00
	1	National Reserve	Lake Maracaibo	10,697.53	19,618,122.98	1,833.67
	4	Exploration	Apure	98,840.00	1,941,747.57	19.64
	10			225,685.23	$136,413,465.36	$ 604.44
Creole Petroleum Corporation	1	Exploitation	Lake Maracaibo	25,443.71	$ 24,999,383.17	$ 982.53
	2	Exploration	Apure	54,362.00	1,067,961.17	19.64
	2	Exploration	Zulia	44,478.00	873,786.41	19.64
	3	Exploration	Monagos-Sucre	72,449.72	15,229,320.39	210.21
	8	Exploration	Barinas	197,680.00	15,080,906.15	76.29
	3	Exploitation	Monagas	77,332.42	19,661,960.52	254.25
	19			471,745.85	$ 76,913,317.81	$ 163.04
Compania Shell de Venezuela	2	Exploitation	Lake Maracaibo	49,420.30	$ 38,935,932.03	$ 787.85
	1	National Reserve	Lake Maracaibo	10,186.62	28,020,388.35	2,750.35
	2	Exploration	Tachira	49,420.00	970,873.78	19.64
	3	Exploration	Zulia	49,420.00	970,873.78	19.64
	1	Exploitation	Gulf of Paria	24,710.00	11,763,754.05	476.07
	9			183,156.92	$ 80,661,821.99	$440.40
Signal Exploration Co.; Hancock Oil; Standard of Ohio; Pure Oil Co.	1	Exploitation	Lake Maracaibo	27,614.27	$ 33,679,906.74	$1,219.58
	4	Exploration	Zulia	98,840.00	1,941,747.57	19.64
	5			126,454.27	$ 35,621,654.31	$ 281.70
Venezuelan Sun Oil Company; Venezuelan Atlantic Refining Co.	1	Exploitation	Lake Maracaibo	24,710.00	$ 18,122,977.35	$ 733.43
	2	Exploration	Apure	49,420.00	970,873.78	19.64
	3			74,130.00	$ 19,093,851.13	$ 257.57
Venezuelan Sun Oil Co.; Venezuelan Atlantic Refining; **Seaboard Oil; Pan Venezuelan Oil**	1	Exploitation	Lake Maracaibo	24,710.00	$ 32,686,084.14	$1,322.79
Venezuelan Sun Oil Co.; Venezuelan Atlantic Refining; **Venezuelan American Independent Oil**	1	National Reserve	Lake Maracaibo	2,079.15	$ 1,934,692.56	$ 930.00
San Jacinto Petroleum Co.; Tennessee Gas Transmission; Union Oil & Gas; Lion Murphy Corp.; Petrofina de Venezuela; cie. Financiere Belges des Petroles; Sharples Oil Co.	2	National Reserve	Lake Maracaibo	1,969.38	$ 3,873,786.42	$1,964.54
	1	Exploration	Apure	24,710.00	485,436.89	19.64
	3			26,679.38	$ 4,359,223.31	$ 163.39
San Jacinto Petroleum Co., Phillips Petroleum; **El Paso Natural Gas; Sunray Mid-Continent Oil; Western Natural Gas**	1	Exploitation	Lake Maracaibo	24,710.00	$ 48,543,689.32	$1,964.54
	1	Exploration	Tachira	24,710.00	485,436.89	19.64
	2			49,420.00	$ 49,029,126.21	$ 992.09
Superior Oil Company of Venezuela	1	National Reserve	Lake Maracaibo	7,775.77	$ 22,019,833.98	$2,831.68
	1	Exploration	Apure	24,710.00	485,436.89	19.64
	2			32,485.77	$ 22,505,270.87	$ 692.77
Venezuelan American Independent Oil Co.	1	Exploration	Zulia	23,598.05	$ 540,857.60	$ 22.92
Phillips Petroleum Co.; **Sunray Mid-Continent Oil; Ashland Oil & Refining; Western Natural Gas; El Paso Natural Gas; Kerr-McGee Industries; Pacific Petroleums; Canadian Atlantic Oil Co.**	1	Exploitation	Lake Maracaibo	24,710.00	$ 32,362,459.54	$1,309.69
	1	Exploitation	Monagas	24,710.00	11,362,459.54	459.83
	1	Exploration	Tachira-Zulia	24,710.00	485,436.89	19.64
	1	Exploration	Tachira	24,710.00	485,436.89	19.64
	4			98,840.00	$ 44,695,792.86	$ 452.20
Venezuelan Atlantic Refining Company	1	Exploitation	Gulf of Paria	19,229.32	$ 6,827,508.74	$ 355.06
	3	Exploration	Apure	74,130.00	1,456,310.67	19.64
	4			93,359.32	$ 8,283,819.41	$ 88.73
Venezuelan Atlantic Refining; Sun Oil Co.; **Pan Venezuelan Oil Co.**	3	Exploration	Barinas	53,225.34	$ 3,485,436.88	$ 65.48
Venezuelan Atlantic Refining Co.; Sun Oil Co.; **Seaboard Oil Co.; Pan Venezuelan Oil Co.**	1	Exploitation	Barinas	27,865.12	$ 21,937,232.04	$ 787.26
Continental Oil Co.; The Texas Co.; **Ohio Oil Cities Service; Richfield Oil**	6	Exploitation	Gulf of Paria	152,003.57	$101,637,699.03	$ 668.65
	4	Exploration	Apure	98,840.00	1,941,747.57	19.64
	10			250,843.57	$103,579,446.60	$ 412.72
Pan Venezuelan Oil Co. (Pan American)	1	Exploitation	Gulf of Paria	22,263.71	$ 4,665,372.17	$ 209.55
	3	Exploitation	S. Monagas	70,062.74	32,184,043.67	459.36
	4	Exploration	Apure	98,840.00	1,941,747.57	19.64
	8			191,166.45	$ 38,791,163.41	$ 202.92
King-Mill	1	Exploration	Zulia	24,561.74	$ 482,524.27	$ 19.64
	2	Exploration	Barinas	49,420.00	4,207,119.74	85.13
	3			73,981.74	$ 4,689,644.01	$ 63.39
GRAND TOTAL	89			2,029,426.16	$685,221,900.59	$ 337.64

* Bolivares converted to U. S. dollars at 3.09.

See Venezuela maps Pages 136, 137, 138 and 139.



A new drilling barge undergoes final fitting out operations in late May prior to being put into Lake Maracaibo service by Superior Oil Company. Loffland Bros. furnished the crews under a labor contract. The barge's first operation resulted in a successful completion on a 7775-acre concession for which Superior had paid a total of $22 million, or an average of $2,831.68 per acre.

ests that included many companies who had not previously operated in Venezuela. Of the 36 companies with full or partnership interests in various new concessions, 28 were not previous Venezuelan concession owners.

A significant feature was the success of several partnership groups of American companies in getting concessions. Some groups were composed of five, six or more American companies. Several of the groups were composed entirely of outright American independents.

The pooling of interests also was used to a large extent by most of the large oil companies. The only companies who bid entirely alone were Creole Petroleum Company (Standard Oil Company of New Jersey) and Superior Oil Company. Shell Oil was awarded several concessions in which it has full ownership, but Shell also participated in the concessions awarded to Mene Grande Oil Company.

High Prices Paid for Maracaibo. Another feature of the concession awards was the high prices paid for acreage adjacent to production in Lake Maracaibo.

A total of 19 concessions covering 350,174 acres were bid in for $419,-650,851, an average price of $1198 per acre. Maracaibo accounted for less than one-sixth of the acreage covered by new concessions, but was responsible for almost two-thirds of the money spent by companies for new concessions.

The highest per acre price for a Lake Maracaibo concession was the $2,831.68 paid by Superior Oil Company for 7775 acres. The second highest price was $2750 per acre paid by Compania Shell de Venezuela for 10.186 acres.

However, the largest total amount paid for one concession was the $48,543,689 by San Jacinto Petroleum Company, Phillips Petroleum Company, El Paso Natural Gas Company, Sunray Mid-Continent Oil Company, and Western Natural Gas Company for 24,710 acres in Lake Maracaibo.

An accompanying table summarizes the new petroleum concession awards. It shows how much acreage each company or group of companies obtained, how much they paid, and the general location of the concessions. This table also shows partnership interests and what companies are newcomers to the Venezuelan oil industry.

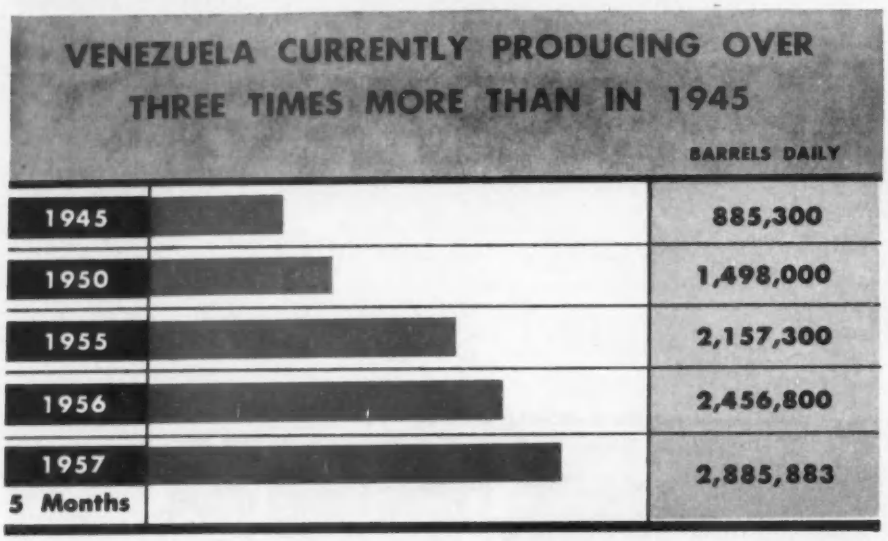
Mene Grande Biggest Investor. Mene Grande Oil Company invested the largest amount of money in new concessions. It paid a total of $136,-413,465 for 225,685 acres. Several others bought concessions covering more acreage, but Mene Grande's investment was increased by its concentration on Lake Maracaibo acreage.

Mene Grande bid in six Lake Maracaibo concessions, covering over 125 million acres, for which it paid almost $134½ million. Mene Grande is owned 50 percent by Gulf Oil Corporation, and 25 percent each by International Petroleum Company and Shell Oil Company of Venezuela.

Creole Petroleum Company obtained concessions on the largest amount of acreage. Creole was awarded a total of 471,745 acres, for which it paid $76,913,317. Only one of Creole's 19 concessions was in Lake Maracaibo.

Concessions in Gulf of Paria. Outside of Lake Maracaibo, the new concessions were featured by those granted in the Gulf of Paria, between Venezuela and Trinidad. Concessions were awarded on over 218 million acres in the Gulf of Paria. They were awarded for nearly $125 million, or an average of $572 per acre.

A group of companies headed by Continental Oil Company obtained the bulk of the Paria concessions. In partnership with Continental Oil are The Texas Company, Ohio Oil Company, Cities Service Oil Company and Richfield Oil Company. This group paid $101⅔ million for six Paria concessions totaling 152,000 acres.



Big Gain in Producing Rates

Venezuela's production of crude oil is undergoing very rapid growth. The rate of increase has been especially large during the past two years. Crude production in 1956 was 14 percent larger than in 1955, and nearly one-third more than in 1954. Last year's record production was three times greater than in 1945 and two-thirds higher than in 1950.

Daily average production during 1956 was 2,456,785 barrels, 300,000 barrels higher than the volume produced in 1955. During the year production rose from 2,324,000 barrels daily in January to a peak of 2,721,000 barrels in December.

Another big increase will take place in 1957. During March, April and May this year, output averaged above 2,900,000 barrels per day, one-fourth more than in the corresponding period of 1956, and one-third higher than in the same months in 1955. It is estimated that Venezuela's production will average 2,850,000 barrels daily for the year 1957 or 300,000 barrels above 1956 rates. This forecast may prove conservative, as it makes allowance for a summer reduction in demand and some production reduction due to return of full-scale Middle East oil to international markets.

Growth Equals Middle East. With the spotlight on the phenomenal progress made in the last decade by the Middle East as an oil producing region, the rapid advancement of Venezuela frequently has been overlooked. This is due partly to the oil industry's tendency to group all Middle East countries, frequently referring to them as if they were one instead of nine separate producing nations.

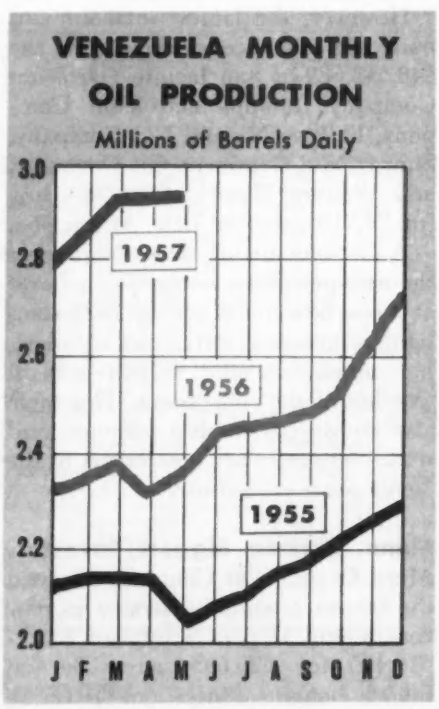
On an individual country basis, Venezuela's producing rate has grown at a faster pace than any Middle East nation during the past decade. In 1956, Venezuela produced 1,400,000 barrels per day more than in 1946. Kuwait and Saudi Arabia, the two leading Middle East producing nations, experienced daily production increases of only 1,000,000 barrels and 820,000 barrels respectively during the same period of time. Venezuela in 1956 produced 2½ times more oil than either Kuwait or Saudi Arabia.

World's Second Largest Producer. Growing production has enabled Venezuela to maintain its rank as the world's second largest producing country. Only the U. S. has produced at a higher rate during the past 10 years.

Venezuela's production of slightly less than 2½ million barrels daily during 1956 is not contested by any other nation. The U.S.S.R. is the world's third ranking area, a distinction gained with a daily production in 1956 of just over 1½ million barrels. The two leading Middle East producing countries, Kuwait and Saudi Arabia, each produced an average of approximately 1 million barrels daily during 1956. It will be a long, long time before Venezuela is replaced as the world's second oil producing country.

Output to Surpass Texas. Rapid expansion of Venezuela's production has already raised its producing volume to the equal of Texas, and it soon will be greater.

In April, 1957, Venezuela's production of 2,921,000 barrels daily compared with Texas' production of 3,207,000 barrels. Drastic reductions



Venezuela Monthly Crude Oil Production
(Barrels Daily)

MONTH	1955	1956	1957
January	2,111,418	2,324,485	2,792,036
February	2,149,751	2,352,746	2,850,212
March	2,144,614	2,391,984	2,923,610
April	2,146,085	2,313,745	2,921,259
May	2,041,234	2,348,554	2,939,985
June	2,072,475	2,446,134	.....
July	2,101,130	2,459,179	.....
August	2,169,648	2,465,533	.....
September	2,183,645	2,493,042	.....
October	2,215,397	2,535,974	.....
November	2,259,542	2,623,347	.....
December	2,278,540	2,721,566	.....

Source: Venezuela Ministry of Mines and Hydrocarbons.

Venezuela Crude Oil Production

	Annually	Daily
1945	323,156,000	885,359
1946	388,486,000	1,064,345
1947	434,905,000	1,191,521
1948	490,015,000	1,338,839
1949	482,316,000	1,321,414
1950	546,783,000	1,498,036
1951	622,216,000	1,704,701
1952	660,254,000	1,803,973
1953	644,243,000	1,765,049
1954	692,294,000	1,896,696
1955	787,413,000	2,157,296
1956	896,596,000	2,456,785
1957 Estimated	1,049,375,000	2,875,000

in Texas' producing rate since April is likely to result in Venezuela's July production surpassing Texas. Daily average production in Texas during 1956 had been 600,000 barrels per day larger than in Venezuela, but Venezuela's swift climb has overcome this margin.

Current producing rates in Venezuela are three times larger than California's output, and 4½ times greater than Oklahoma's production.

Creole Is Largest Producer. Three companies produced 88 percent of Venezuela's crude production in 1956. The largest producer was Creole Petroleum Corporation, subsidiary of Standard Oil Company (New Jersey). Creole produced an average of 1,083,721 barrels daily in 1956, thus accounting for 44 percent of Venezuela's total production. Creole's production averaged 982,364 barrels daily in 1955.

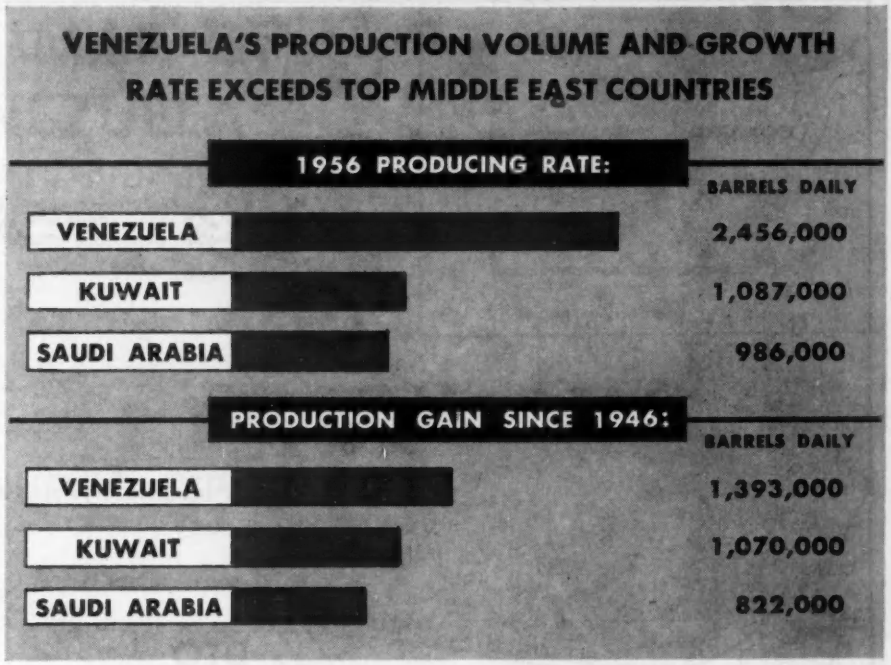
Shell Oil Company of Venezuela was the second largest producer with 710,30 barrels per day in 1956 representing 28.9 percent of Venezuela's output. In 1955 Shell produced an average of 607,420 barrels per day. Mene Grande Oil Company produced an average of 364,658 barrels per day in 1956, which was 14.8 percent of Venezuela's total. This was in contrast with the production of 316,732 barrels daily in 1955.

By April, 1957, Creole had increased its producing rate to 1,253,000 barrels daily; Shell to more than 900,000 barrels per day; and Mene Grande was producing 416,000 barrels daily.

Socony Mobil Oil Company, fourth largest producer in the nation, boosted its production from an average of 70,000 barrels daily in 1955 to 97,157 barrels in 1956, and then to 114,433 by April, 1957.

One of the largest increases in producing rates has been achieved by Richmond Exploration Company, subsidiary of Standard Oil Company of California. Richmond's production

(Continued on Page 140; See Maps Pages 136-139)



Distribution of Venezuela Crude Oil Production

STATE	Barrels Daily 1956	Barrels Daily 1954	Percent of Country 1956	Percent of Country 1954	Change From 1954 to 1956 Barrels	Change From 1954 to 1956 Percent
Zulia	1,723,926	1,296,202	70.17	68.34	+ 427,724	+ 32.9
Lagunillas Field	693,796	476,829	28.24	25.14	+ 216,967	+ 45.5
Bachaquero Field	399,719	215,275	16.27	11.35	+ 184,444	+ 85.7
Tia Juana Field	232,412	215,085	9.46	11.34	+ 17,327	+ 8.0
La Paz Field	149,372	77,575	6.08	4.09	+ 71,797	+ 92.5
Other Fields	248,627	311,438	10.12	16.42	— 62,811	— 20.2
Anzoatequi	533,122	410,066	21.70	21.62	+ 123,056	+ 30.0
Nipa Field	70,018	36,417	2.85	1.92	+ 33,601	+ 92.3
Oficina Field	57,243	56,142	2.33	2.96	+ 1,101	+ 1.9
Guara Field	49,381	51,021	2.01	2.69	— 1,640	— 3.2
Chimire Field	42,257	40,779	1.72	2.15	+ 1,478	+ 3.6
Other Fields	314,223	225,707	12.79	11.90	+ 88,516	+ 39.2
Monagas	129,473	115,698	5.27	6.10	+ 13,775	+ 11.9
Quiriquire Field	64,368	69,798	2.62	3.68	— 5,430	— 7.8
Other Fields	65,105	45,900	2.65	2.42	+ 19,205	+ 41.8
Guarico	42,748	46,469	1.74	2.45	— 3,721	— 8.0
Other States (Barinas, Trujillo, Falcon and Amacuro Delta)	27,516	28,260	1.12	1.49	— 744	— 2.6
Total Venezuela	2,456,785	1,896,696	100.00	100.00	+ 506,089	+ 26.7

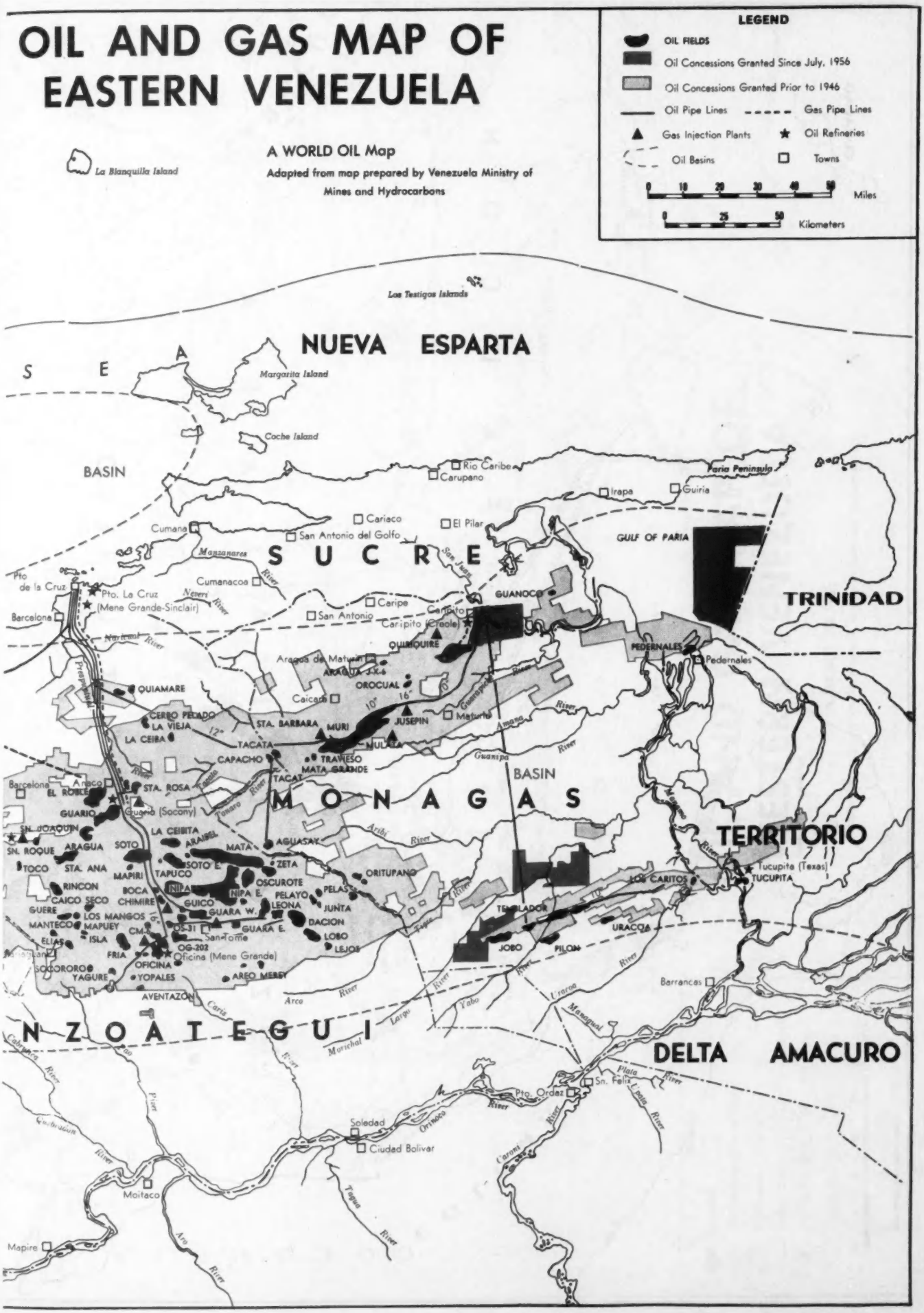
Venezuela Crude Oil Production Rises to New Peak in 1956

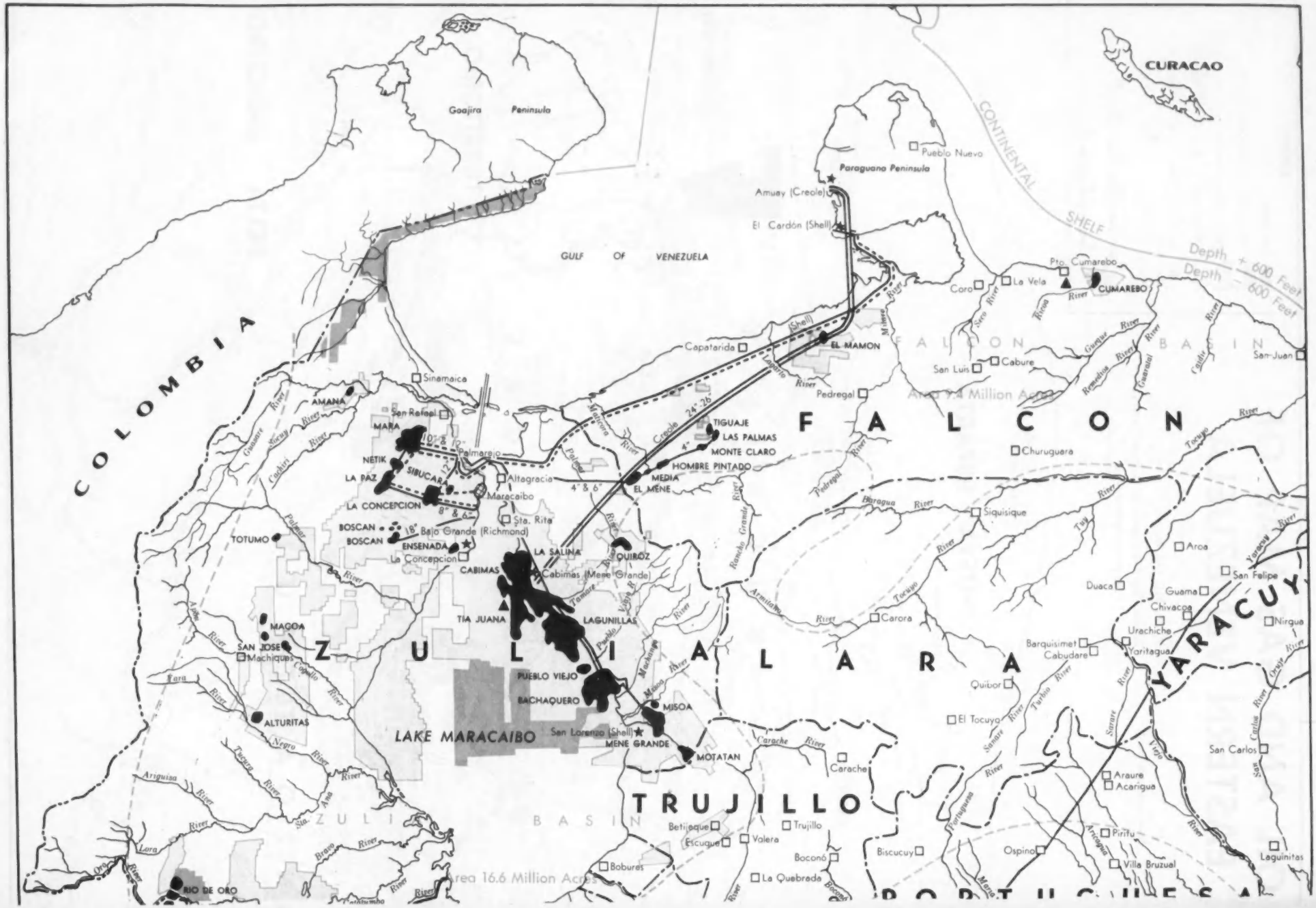
NAME OF COMPANY	PRODUCTION—Barrels Year 1955	Daily 1955	Year 1956	Daily 1956	Change Barrels Daily	Percent Change	PRODUCING OIL WELLS END OF 1956 Flowing	Artificial Lift	Total
Creole Petroleum Corporation	358,562,860	982,364	396,641,886	1,083,721	+101,357	+ 10.3	1,750	1,989	3,739
Compania Shell De Venezuela	221,708,300	607,420	259,969,800	710,300	+102,880	+ 16.9	466	5,133	5,599
Mene Grande Oil Company	115,607,180	316,732	133,464,828	364,658	+ 47,926	+ 15.1	1,116	1,270	2,386
Socony Mobil Oil Company	25,553,285	70,009	35,559,462	97,157	+ 27,148	+ 38.7	340	85	425
Texas Petroleum Company	17,507,225	47,965	17,237,502	47,097	— 868	— 1.9	131	7	138
Richmond Exploration Company	16,458,580	45,092	22,597,572	61,742	+ 16,650	+ 36.9	6	252	258
Sinclair Oil and Refining Company	9,029,735	24,739	10,638,156	29,066	+ 4,327	+ 17.4	177	162	339
S. A. Petrolera Las Mercedes	8,895,050	24,370	8,822,430	24,105	— 265	— 1.1	236	134	370
Venezuelan Atlantic Refining Company	7,196,705	19,717	7,343,424	20,064	+ 347	+ 1.7	103	150	253
Phillips Petroleum Company	3,374,425	9,245	4,052,718	11,073	+ 1,828	+ 19.7	141	213	354
Pantepec Oil Company	2,768,160	7,584	1,793,400	4,900	— 2,684	— 35.4	3	1	4
Talon Petroleum Company	618,310	1,694	999,180	2,730	+ 1,036	+ 61.1	12	81	93
Coro Petroleum Company	59,495	163	25,620	70	— 93	— 57.1	5	1	6
Caracas Petroleum Company	44,530	122	37,332	102	— 20	— 16.4	1	....	1
Total	787,383,840	2,157,216	899,183,310	2,456,785	+299,569	+ 13.8	4,487	9,478	13,965

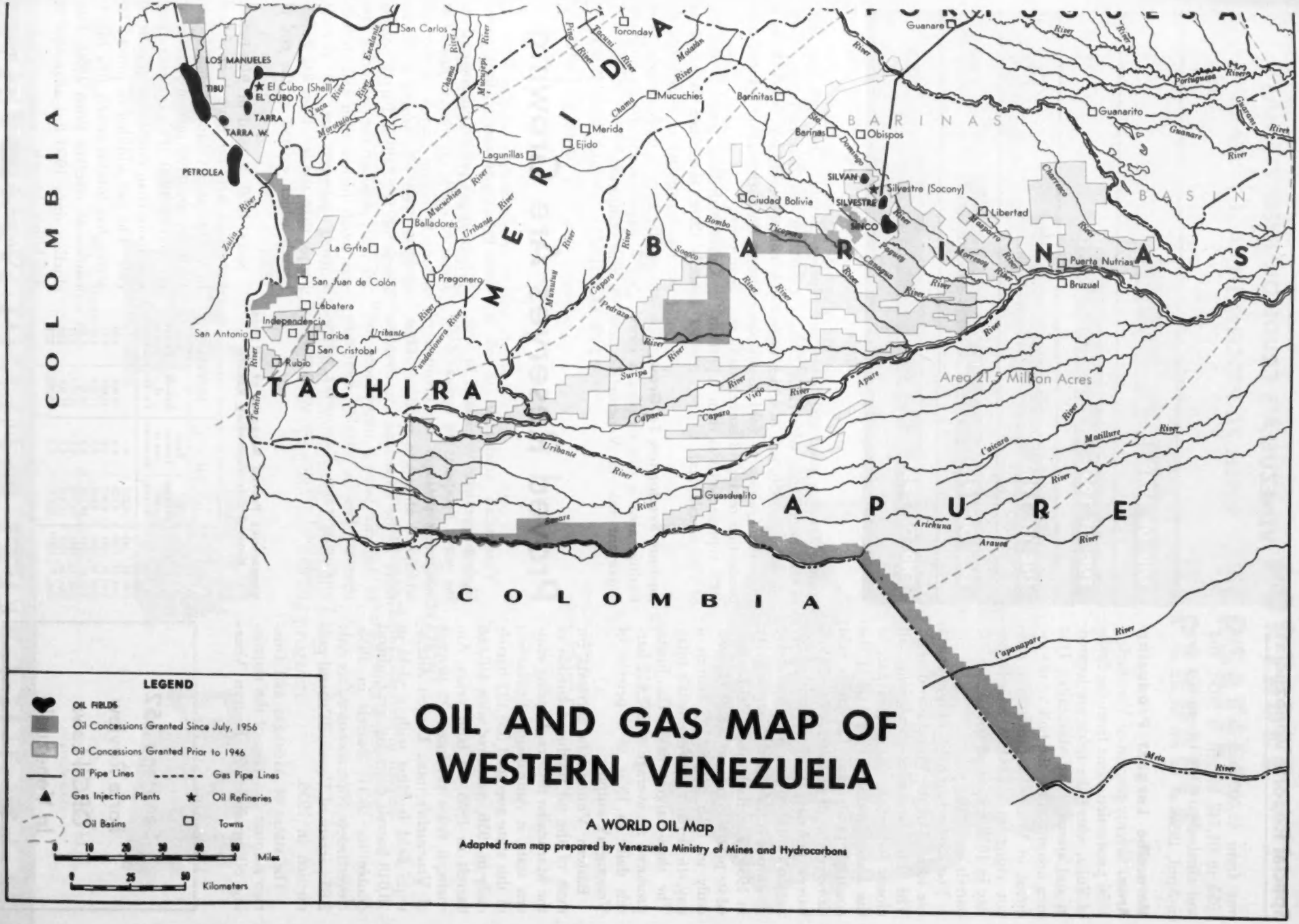
Source: Venezuela Ministry of Mines and Hydrocarbons.

BONAIRE
Los Roques Islands
Orchila Island
CARIBBEAN
Depth + 600 Feet
Depth − 600 Feet
Area 22.2 Million Acres
CONTINENTAL SHELF
Tortuga Island
Tucacas
DTO FEDERAL
CARIACO
Area 4.4 Million Acre
Pto. Cabello
Turiamo
Caracas
Petare
Guarenas
Buatire
Higuerote
Los Teques
Sta. Lucia
Caucagua
Rio Chico
Montalbán
Bejuma
Guacara
Valencia
LAKE VALENCIA
Maracay
Turmero
La Victoria
Aragua River
Cud
Cumaca del Tuy
ARAGUA
MIRANDA
CARABOBO
Guigue
Villa de Cure
San Casimiro
San Sebastian
San Juan de Los Morros
Tinequillo
MATURIN
Pto. Piritu
Ciarines
Altagracia de Orituco
El Pao
COJEDES
El Sombrero
Barbacoas
PLACER
BRUZUAL
Araguaca
BARBACOAS
TUCUPIDO TAMAN
CASCARONCITO
San Roque (Phillips)
ROBLOTE
LECHOSO
LAS MERCEDES
DAKOA
Zaraza
Valle de la Pascua
SABAN
APAMATE
LOS OLLAS
EL CHAPARRO
GRICO
PUNZON
BELEN
PIRAGUA
GUAVINITA
PALACIO
ROSITAS
RUIZ
BELLA VISTA
MAHOMAL
COPORO
ANIBAL
SAN FELIX
RETUMBO
LAKE GUARICO
Calabozo
El Baúl
GUARICO
Area 35.6 Million Acres
Arismendi
San Fernando de Apure
Caicara
Apure River
Sipapo River

OIL AND GAS MAP OF EASTERN VENEZUELA




CURACAO
Goajira Peninsula
Paraguana Peninsula
Pueblo Nuevo
Amuay (Creole)
El Cardón (Shell)
CONTINENTAL SHELF
Depth + 600 Feet
Depth - 600 Feet
GULF OF VENEZUELA
COLOMBIA
Pto. Cumarebo
CUMAREBO
Coro
La Vela
EL MAMON
Capatarida
Sinamaica
AMANA
San Rafael
MARA
NETIK
LA PAZ
SIBUCARA
LA CONCEPCION
Palmarejo
Altagracia
Maracaibo
Sta. Rita
Bajo Grande (Richmond)
BOSCAN
BOSCAN
ENSENADA
La Concepcion
TOTUMO
CABIMAS
Cabimas (Mene Grande)
LA SALINA
QUIROZ
TIGUAJE
LAS PALMAS
MONTE CLARO
HOMBRE PINTADO
MEDIA
EL MENE
TIA JUANA
LAGUNILLAS
PUEBLO VIEJO
BACHAQUERO
MISOA
San Lorenzo (Shell)
MENE GRANDE
MOTATAN
MACOA
SAN JOSE
Machiques
ALTURITAS
LAKE MARACAIBO
Z U L I A
F A L C O N
Area 14.4 Million Acres
Churuguera
Siquisique
Carora
Duaca
Arca
San Felipe
Guama
Chivacoa
Urachiche
Yaritagua
Barquisimet
Cabudare
Nirgua
Quibor
El Tocuyo
L A R A
YARACUY
San Carlos
Araure
Acarigua
Piritu
Villa Bruzual
Leguinitas
Ospino
Biscucuy
Boconó
Betijoque
Escuque
Trujillo
Valera
La Quebrada
Bobures
RIO DE ORO
Area 16.6 Million Acres
T R U J I L L O
P O R T U G U E S A
Carache
Pedregal
San Luis
Cabure
San-Juan
Churuguera
Siquisique
Carora
Duaca
Arca
Quibor
El Tocuyo
Araure
Acarigua
Ospino
Biscucuy
Boconó
Betijoque
Escuque
Trujillo
Valera
La Quebrada
Bobures
Pedregal
Area 7.4 Million Acres



OIL AND GAS MAP OF WESTERN VENEZUELA

A WORLD OIL Map

Adapted from map prepared by Venezuela Ministry of Mines and Hydrocarbons

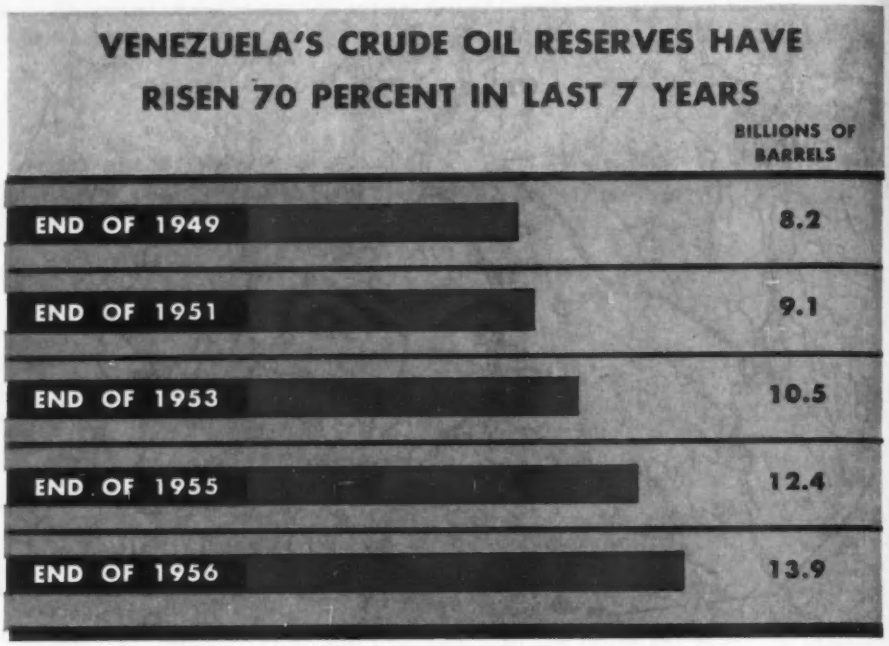
rose from 45,000 barrels a day in 1955 to 61,742 barrels in 1956, and had climbed to 94,861 barrels a day in April, 1957.

Maracaibo Largest Producing Area. Seventy percent of Venezuela's 1956 production came from the State of Zulia, where the fields are located in and around Lake Maracaibo. This area accounted for the bulk of the increase in Venezuela production, output rising to 1,723,926 barrels per day in 1956 compared with 1,296,202 barrels in 1955.

The six leading fields of Venezuela are located in the Maracaibo district. The three largest of these fields, all closely located in the eastern part of the Lake, produced over half of the country's production. Lagunillas field alone produced an average of 693,796 barrels per day, or 28 percent of the nation's total output, after increasing its output from 476,829 barrels a day in 1955. The Bachaquero field boosted its production from 215,275 barrels daily in 1955 to 399,719 barrels a day, 16 percent of Venezuela's total. The third largest field, Tia Juana, produced an average of 232,412 barrels daily in 1956, or 9 percent of Venezuela's output.

Eastern Venezuela accounts for most of the oil produced outside of the Maracaibo district. Leading eastern state is Anzoatequi. Production of this state averaged 533,122 barrels daily in 1956, compared with 410,066 barrels in 1955. In both years, Anzoatequi fields produced 21 percent of Venezuela's total. Largest Anzoatequi field is Nipa with a yield of 70,018 barrels daily last year, almost double its 36,417 barrels in 1955. Nevertheless, Nipa accounted for only 2.85 percent of Venezuela's total production in 1956.

The states of Monagas and Guarico account for most of the remaining oil produced in Eastern Venezuela. Monagas produced 5 percent of the nation's total with 129,473 barrels daily in 1956, half of which came from the Quiriquire field. Guarico's production of 42,748 barrels daily in 1956 represented less than 2 percent of Venezuela's total.



Barinas Production To Grow. The Barinas area is due to play a more important role in Venezuela's producing picture. The first pipe line outlet for the Barinas region is under construction, a 212-mile 20-inch line to Puerto Cabello on the Caribbean coast.

Current drilling plans in the region's three fields are expected to develop a capacity of 30,000 barrels to 40,000 barrels daily, maybe even 50,000 barrels a day, by the time the line is completed.

Proved Reserves Are Growing

Venezuela's production of oil is likely to continue to expand in coming years. Prospects for increased development presages the creation of additional ability to produce. Then, there is the important consideration of current proved unproduced rereserves. Despite steadily increasing producing rates, Venezuela's proved crude and natural gas reserves continue growing to new all-time peaks.

Venezuela's proved unproduced reserves of crude oil were estimated at nearly 14 billion barrels at the end of 1956. This represented a net increase of 1½ billion barrels during the year, although the producing rate was much higher than ever before. Current reserves are 60 percent higher than the less than 8¾ billion barrels which existed at the end of 1950.

Since 1950, a total of 9½ billion barrels of new oil have been found in Venezuela, a volume slightly larger than the country's proved reserves at the end of 1950. This discovery rate was more than double the producing rate. The net addition to proved reserves has totaled nearly 5¼ billion barrels to reserves since 1950. Production since 1950 has amounted to 4¼ billion barrels.

Venezuela's natural gas reserves

Venezuela's Proved Reserves of Oil and Natural Gas Expanding Rapidly

	OIL		NATURAL GAS	
	Millions of Barrels	Ratio Production to Reserves	Billions of Cu. Ft.	Ratio Production to Reserves
Dec. 31, 1949	8,215	5.8	.....	...
Dec. 31, 1950	8,724	6.3	16,904	3.20
Dec. 31, 1951	9,063	6.9	16,933	3.87
Dec. 31, 1952	9,428	7.2	17,212	4.03
Dec. 31, 1953	10,152	6.9	19,353	3.48
Dec. 31, 1954	10,919	6.3	21,019	3.27
Dec. 31, 1955	12,429	6.3	23,304	3.06
Dec. 31, 1956*	13,951	6.4	26,950	2.97

* Estimate.
Source: Venezuela Ministry of Mines and Hydrocarbons

See Page 352
For a Review
Of Oil Laws
In Venezuela

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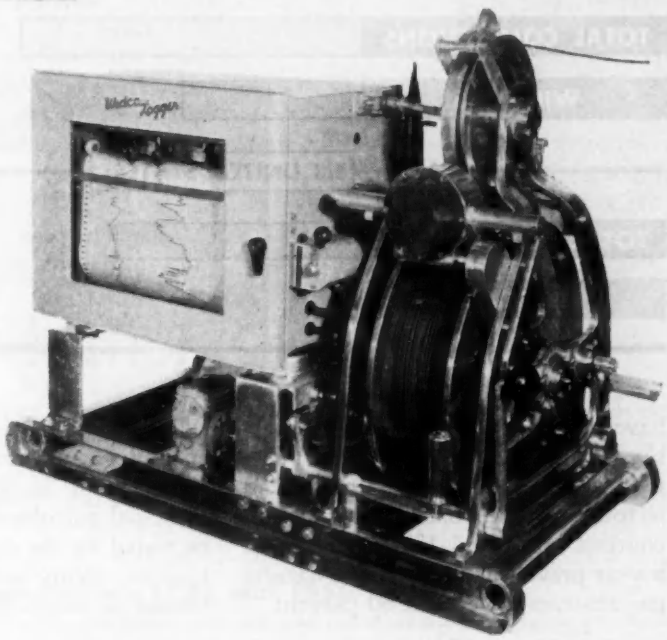

WIDCO 2000 ft. Logger
Model XM Type PR

SHOT HOLES: Determination of best shooting point, correlation.

CORE HOLES AND STRAT HOLES: Correlation, fault mapping.

SHALLOW OIL WELLS: Correlation, formation identification, casing depth determination, secondary recovery, etc.

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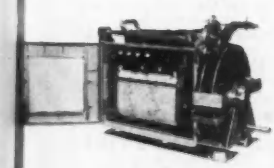
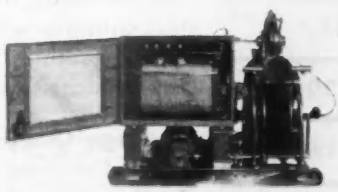
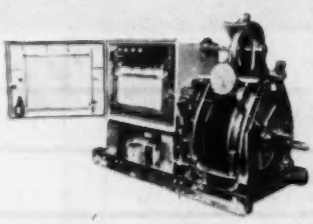


1000 ft. Logger
Model Y Type PR



2000 ft. Logger
Model XM Type PR



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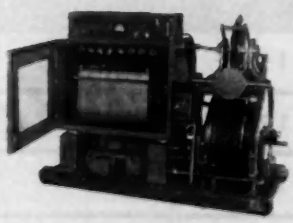
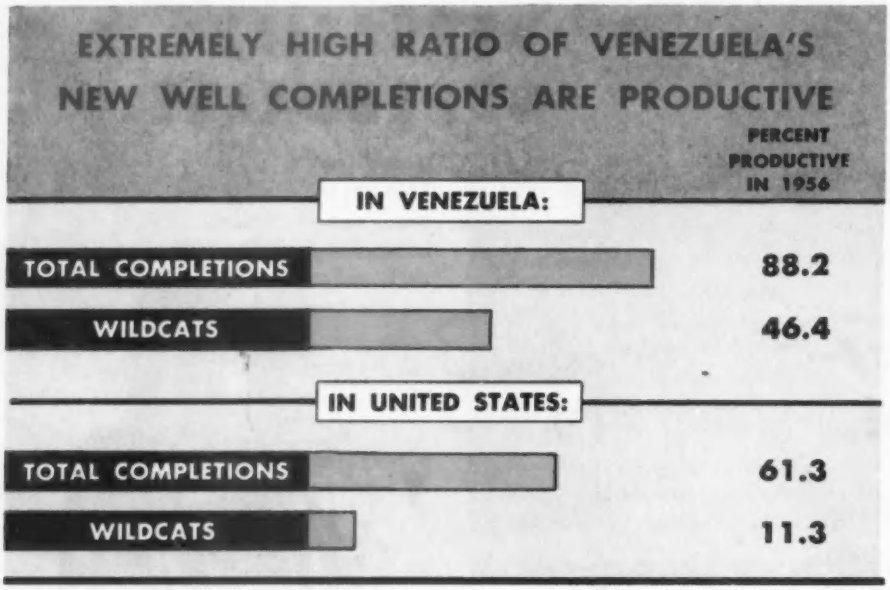


3500 ft. Logger
Model WMA-12 Type PR2N
(Multiple-Electrode)

WELL INSTRUMENT DEVELOPING CO.
HOUSTON, TEXAS
MAILING ADDRESS: P. O. BOX 282, BELLAIRE, TEXAS • CABLE ADDRESS: WIDCO, HOUSTON, TEXAS



have increased by an equally impressive volume. At the end of 1956, natural gas reserves were calculated to total nearly 27 billion cubic feet, in contrast with 23⅓ billion cubic feet a year previously. Since 1956, natural gas reserves have risen 60 percent.

The chances of finding additional oil and gas in Venezuela are bright. Large areas in the country's three principal petroleum basins remain to be tested by the drill. Success to date indicates many more new discoveries should be made in the future.

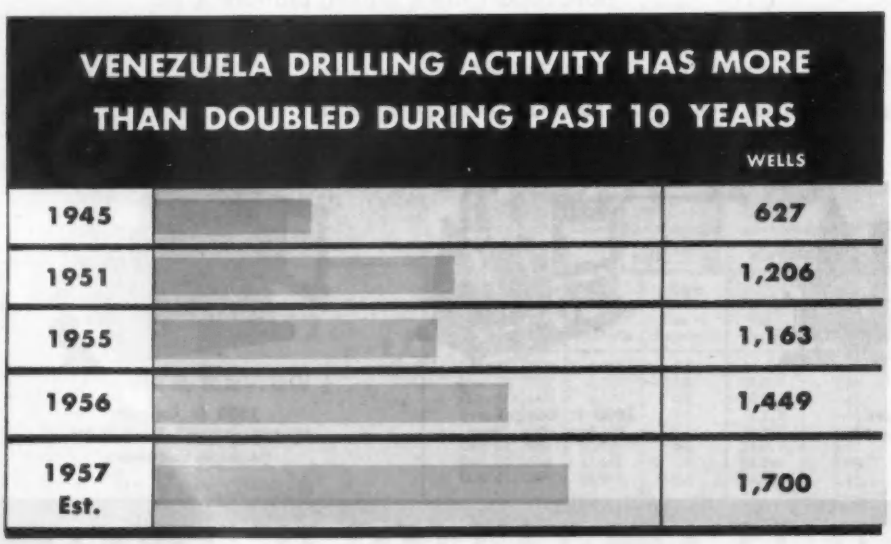
Sharp Growth in Drilling Activity

Stimulated by rising production, Venezuela's drilling activity has grown at very rapid pace in recent years. The year 1956 saw one-fourth more wells completed and nearly one-third more footage drilled than in 1956.

This boosted total well completions to a new peak of 1449 wells in contrast with 1163 wells in 1955 and but 836 during 1954. Footage drilled rose to 9,594,605 feet, compared with 7,486,103 feet in 1955 and 6,019,140 feet in 1954. The previous peak in Venezuela drilling was in 1952, when 1313 wells were completed and 7,227,744 feet of hole was drilled.

A total of 1700 completions are predicted for 1957, or 17 percent above the peak attained in 1956.

Venezuela is the third most active drilling area in the world, outranked only by the U. S. and Canada. Completions in 1956 were double the number drilled in either 1950 or 1949.



New Drilling Peaks Ahead. Further gains in Venezuela drilling activity seem certain. Growth in production will spur drilling activity. But the most important factor presaging higher drilling rates is the granting of new oil concessions. Some new concessions were adjacent to production in Lake Maracaibo, and these holdings will undergo immediate development. In addition, the fact that a number of companies not heretofore operating in Venezuela were successful bidders on new concessions will increase drilling activity. All these factors indicate higher drilling rates for Venezuela.

If Venezuela's high success ratio holds for the new concession areas, some extensive development drilling programs may be in the offing.

High Ratio of Producing Wells. New operators were no doubt in part attracted to Venezuela by the extremely high ratio of productive wells completed annually.

Of the 1449 wells completed during 1956 in Venezuela, 1278 or 88 percent were productive. This impressive figure was equalled by the portion of wildcats which found production. Of the 138 wildcats completed in 1956, there were 64 which found production. This meant nearly half of the wildcats drilled were productive.

The Maracaibo district led in wildcat success, with 52 percent of all wildcats drilled finding production. In the Barcelona region, 49 percent of the wildcats were productive, while in the Maturin region 28 percent of the wildcats were productive.

Footage Climbs to New Peak. Increased drilling and greater depths combined to push the amount of footage drilled to a new peak. A total of 9,584,607 feet of hole was drilled in 1956, compared with 7,486,103 feet in 1955. Prior to 1950, the peak in drilling was the 4,349,108 feet drilled

in 1948, or less than half the 1956 volume.

If drilling reaches the 1700 wells predicted for 1957, footage should rise to about 11,267,000 feet.

Maracaibo Leads in Drilling. The most active drilling region in Venezuela is the Maracaibo district. Half of all wells completed in Venezuela during 1956 were in the Maracaibo district. A total of 731 wells were completed in Maracaibo during 1956, in contrast with 564 during 1955.

The Barcelona district had 532 completions in 1956, which represented one-third of the country's completions. This compared with the drilling of 455 wells in 1955. The adjoining Maturin region increased its completions from 132 in 1955 to 170 during 1956.

Contractors Are More Active. An increasing number of U. S. contractor rigs are active in Venezuela. An average of 140 to 150 rigs have been working in Venezuela, of which just slightly over half are contractor owned rigs.

Nine U. S. drilling contractors now operate in Venezuela. Largest is Loffland Brothers, with 30 rigs. Delta Drilling Company, which operates under the name of Perforaciones Delta C. A., is the second largest contracting firm. Delta also recently purchased controlling interest in Perforaciones & Service C. A., which had operated in Venezuela for some years.

Latest entry is Helmerick & Payne, which has purchased 5 rigs from Sinclair Oil & Refining Company.

Falcon Seaboard Drilling Company recently purchased D & D Drilling & Construction Company. Other U. S. drilling contractors active in Venezuela are: Santa Fe Drilling Company; Servicos Technicos Orientales C. A. (recently purchased by General Investment Company); Brown International Drilling Company; and Kermac Drilling Company.

Venezuela Drilling

	Wells	Footage
1946	627	3,379,711
1947	787	4,161,181
1948	889	4,349,108
1949	670	3,799,209
1950	603	3,356,890
1951	1,206	5,432,680
1952	1,313	7,227,744
1953	951	6,019,140
1954	836	6,025,538
1955	1,163	6,541,819
1956	1,449	9,594,605
1957 Estimated	1,700	11,267,000

Gas Production Growing

Along with higher oil producing rates, the production of natural gas in Venezuela has increased sharply. A total of 976.5 billion cubic feet of natural gas was produced during 1956, double the quantity produced in 1949.

Great strides are being made in gas

Venezuela Well Completions and Footage Drilled, 1956 and 1955 by Districts

	WELLS COMPLETED				WILDCATS COMPLETED						FOOTAGE DRILLED	
	Total		Productive		Total		Productive		Percent Productive		(Total Wells Completed)*	
DISTRICT	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956	1955
Maracaibo	731	564	683	541	24	39	15	20	62.50%	51.28%	2,796,165	2,884,765
Barcelona	532	455	458	369	83	93	41	39	49.39%	41.93%	4,456,247	3,683,102
Maturin	170	132	124	109	29	27	8	10	27.86%	37.03%	1,156,303	792,185
Barinas-Apure	16	12	13	7	2	12	0	7	.....	58.33%	185,892	126,052
Total	1,449	1,163	1,278	1,026	138	171	64	76	46.37%	44.44%	9,594,607	7,486,103

* Footage drilled includes footage of wells redrilled, which in 1956 amounted to 748 feet and in 1955 to 14,981 feet.
Source: Venezuela Ministry of Mines and Hydrocarbons.

Summary of Drilling Activities in Venezuela During 1956, by Company and Area

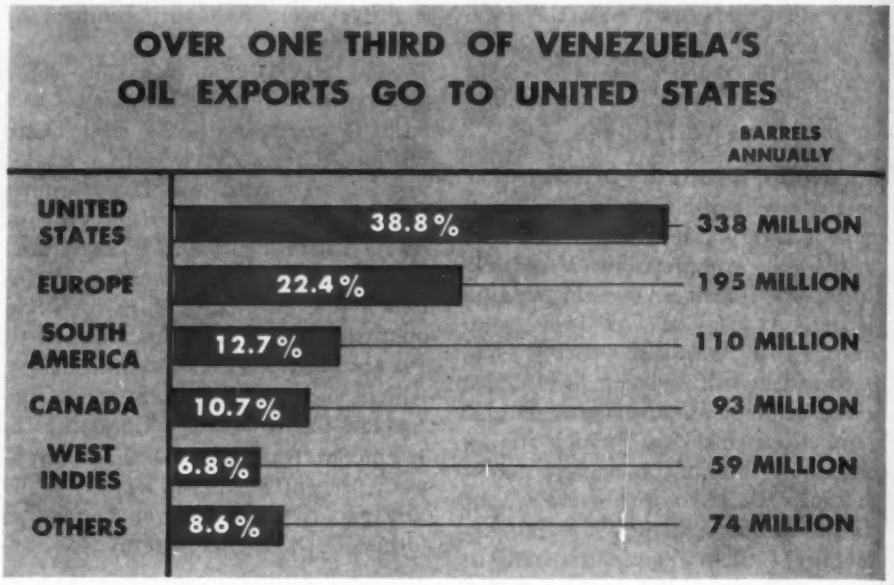
		COMPLETED WELLS				PRODUCTIVE WELLS COMPLETED							
COMPANY	District	Development Wells	Extension Wells	Wildcats	Total	Development Wells	Extension Wells	Wildcats	Total	Dry Holes	Wells Drilling as of Dec. 31, 1956	Wells Suspended	Wells Recompleted
Creole Petroleum Corporation	Maracaibo	97	18	13	128	97	16	11	124	4	17	10	1
Creole Petroleum Corporation	Barcelona	18	84	9	111	17	80	7	104	7	3	3	..
Creole Petroleum Corporation	Maturin	24	12	11	47	22	6	2	30	17	5	9	..
Compania Shell de Venezuela	Maracaibo	382	51	7	440	375	45	3	423	17	32	12	2
Compania Shell de Venezuela	Barcelona	0	1	2	3	0	0	1	1	2	0	1	..
Compania Shell de Venezuela	Maturin	6	0	1	7	6	0	0	6	1	1	1	..
Colon Development Company	Maracaibo	11	0	2	13	11	0	0	11	2	3	4	..
Mene Grande Oil Company	Maracaibo	12	1	0	13	12	1	0	13	0	3	1	..
Mene Grande Oil Company	Barcelona	64	111	27	202	64	103	17	184	18	20	16	2
Mene Grande Oil Company	Maturin	6	29	5	40	5	16	0	21	19	5	0	1
Venezuelan Atlantic Refining Co.	Barcelona	0	4	8	12	0	3	2	5	7	1	2	..
Venezuelan Atlantic Refining Co.	Maturin	4	4	5	13	4	3	2	9	4	1	0	..
Texas Petroleum Company	Maracaibo	6	7	2	15	6	3	1	10	5	2	1	..
Texas Petroleum Company	Barcelona	11	13	4	28	11	11	2	24	4	7	0	..
Texas Petroleum Company	Maturin	0	0	1	1	0	0	1	1	0	0	0	..
S. A. Petrolera Las Mercedes	Barcelona	19	25	29	73	16	17	8	41	32	8	8	1
S. A. Petrolera Las Mercedes	Maturin	5	0	1	6	5	0	1	6	0	1	4	..
Compania Espanola de Petroleos	Maracaibo	0	0	0	0	0	0	0	0	0	0	1	..
Sinclair Oil & Refining Co.	Barcelona	2	1	2	5	1	0	2	3	2	2	0	..
Sinclair Oil & Refining Co.	Maturin	35	0	4	39	33	0	2	35	4	2	0	..
Sinclair Oil & Refining Co.	Barinas-Apure	12	0	2	14	11	0	0	11	3	2	0	..
Richmond Exploration Co	Maracaibo	61	23	0	84	61	20	0	81	3	9	0	..
Socony Mobil Oil Company	Barcelona	41	24	0	65	41	23	0	64	1	16	0	..
Socony Mobil Oil Company	Barinas-Apure	2	0	0	2	2	0	0	2	0	1	2	..
Pantepec Oil Company	Barcelona	3	0	0	3	3	0	0	3	0	0	0	..
Pantepec Oil Company	Maturin	0	0	1	1	0	0	0	0	1	0	0	..
Phillips Petroleum Company	Barcelona	24	4	2	30	23	4	2	29	1	1	9	..
Phillips Petroleum Company	Maturin	14	2	0	16	14	2	0	16	0	0	3	..
Talon Petroleum Company	Maracaibo	0	38	0	38	0	21	0	21	17	1	12	..
Total	.....	859	452	138	1,449	840	374	64	1,278	171	144	99	7

utilization and conservation. Three times more gas was utilized in 1956 than in 1949, and nearly five times as much was reinjected into the oil formation as in 1949. The amount reinjected into the producing formation has more than doubled in the last two years. A total of 171 billion cubic feet was returned to producing formations in 1956. This will increase considerably in 1957. Consequently, a steadily smaller portion of Venezuela's gas is being vented despite rising production.

Despite the increase in volume consumed, natural gas consumption in Venezuela is relatively small. However, it is due to increase. A new petrochemical plant has been completed at Moron, near Puerto Cabello. The completed portion will utilize natural gas to make fertilizer, caustic soda etc. Later additions are planned to expand the petrochemical industry.

To supply the petrochemical plant a 26-inch 205-mile pipe line is being built from Anaco, Eastern Venezuela. Enroute, this line will supply gas to an electric generating plant at La Mariposa, to the city of Caracas, to Maracay, and the industrial city of Valencia.

The government is studying plans to build other natural gas distribution systems. At present only the City of Maracaibo, two subdivisions at Caracas, and the towns of Barcelona and Puerto La Cruz are supplied with natural gas.



Market Outlook Is Bright

Venezuela supplies large quantities of oil to international petroleum markets. It is the world's largest oil exporting nation. Over 95 percent of Venezuela's production is exported to other nations.

During 1956, a total of 869,820,000 barrels of crude and refined products were exported, a substantial increase from the 566,267,000 barrels exported in 1955. In contrast, Kuwait, the world's second largest oil exporting nation, shipped less than half this amount.

A Number of Market Advantages. A number of factors play a part in Venezuela exporting more oil than any other nation. Of course, an adequate supply is the first consideration. Another important factor is its proximity to the U. S., the world's largest consuming area.

Still another very significant factor is the world-wide shortage of heavy fuel oil. This situation works to Venezuela's advantage because a large portion of its production is low gravity oil ideally suited for the manufacture of fuel oils.

Crude oil constitutes almost half of Venezuela's annual exports, and much of the crude is purchased because of its fuel oil value. Fuel oils (exclusive of gas oil and diesel oil) make up one-third of Venezuela's total exports. All other refined products comprise only 20 percent of Venezuela's total exports.

Venezuela has other market advantages. In addition to its proximity to the U. S., Venezuela is the closest oil surplus region to some of the fastest petroleum growing markets in the world. The use of oil is expanding rapidly in Central America, the

Growth of Venezuela Crude and Product Exports by Destination

(Includes Shipments from Netherlands Antilles refinery. Figures in Thousands of Barrels Annually at 60° F.)

DESTINATION	Total Crude and Products Exported			Percent of Total Crude and Products			Crude Oil Exports			Fuel Oil Exports (Exc. Gas, Oil and Diesel Oil)			Other Products Besides Fuel Oil		
	1951	1955	1956	1951	1955	1956	1951	1955	1956	1951	1955	1956	1951	1955	1956
United States	219,451	298,760	337,705	38.8	39.6	38.8	107,767	141,696	164,895	106,951	136,883	145,584	4,733	20,182	27,226
Canada	51,824	81,906	92,894	9.1	10.9	10.7	45,163	67,551	78,619	2,719	4,945	4,154	3,942	9,510	10,121
Others	630	1,104	926	0.1	0.1	0.1	0	0	0	630	777	321	0	327	605
North America Total	271,905	381,770	431,525	48.0	50.6	49.6	152,930	209,247	243,514	110,300	142,505	150,059	8,675	30,019	37,952
Central America	8,394	11,558	16,158	1.5	1.5	1.9	0	0	0	4,242	4,738	8,163	4,132	6,820	7,995
Antilles (W. Indies)	33,372	50,491	59,326	5.9	6.7	6.8	14,271	19,774	27,730	12,755	17,210	17,327	6,346	13,507	14,270
South America	70,060	97,908	110,113	12.4	13.0	12.7	11,448	37,105	47,017	31,033	29,323	36,180	27,579	31,480	26,915
Europe	135,807	157,270	195,107	24.0	20.8	22.4	25,012	65,003	88,068	37,812	27,334	44,570	72,983	64,934	62,470
Asia	5,991	4,929	4,647	1.0	0.6	0.5	4,539	464	380	695	2,621	1,930	757	1,844	2,337
Africa	20,035	19,554	21,327	3.5	2.6	2.5	0	0	0	10,025	8,448	9,631	10,010	11,106	11,696
Oceania	2,125	2,334	2,007	0.4	0.3	0.2	0	897	806	1,074	0	0	1,051	1,437	1,200
Others	18,598	29,056	29,610	3.3	3.9	3.4	0	0	0	17,460	21,273	22,053	1,138	7,783	7,557
Total	566,267	754,871	869,820	100.0	100.0	100.0	208,200	332,490	407,515	225,396	253,452	289,913	132,671	168,930	172,392

Source: Venezuela Ministry of Mines and Hydrocarbons.

West Indies and South America.

Venezuela improved its competitive market position during 1956 with the opening of a deep-draft channel at the entry to Lake Maracaibo. It no longer is necessary to carry oil out of the lake in small tankers and reload on ocean going tankers. Large ocean tankers now can be loaded in the lake. Creole and Shell will soon open large tanker loading terminals inside the lake. This will reduce the cost of handling a large portion of Venezuela crude.

Due to its type of crude, location, and the world need for fuel oil, Venezuela will continue to enjoy market advantages in future years. Little difficulty should be experienced in selling Venezuela oil. Expanding markets will provide increased outlets in the years ahead.

The world's need for fuel oil has become so great an intensive effort is being made to expand Venezuela's production of very low gravity crude. Fields that have not been developed because of their low gravity oil are now being developed and produced. Some of them range down to 8 gravity crude.

U. S. Is Biggest Customer. The biggest purchaser of Venezuela oil is the U. S. During 1956 the U. S. bought 337¾ million barrels of Venezuela oil, 38.8 percent of the country's total exports.

Although shipments to Europe increased sharply because Suez blockage disrupted normal Middle East movements, only 195 million barrels of Venezuela oil were shipped to Europe. This comprised 22 percent of Venezuela's total shipments.

South America was the third largest buyer of Venezuela crude in 1956, purchasing 110 million barrels. Canada was the next best customer with nearly 93 million barrels.

Half of the shipments to the U. S. were crude oil, and most of the remainder was heavy fuel oil. Almost as much fuel oil was shipped to the U. S. as crude oil. Shipments of crude oil totaled 165 million barrels, heavy fuel oil over 145 million, and all other refined products but 27 million barrels.

Thus, the U. S. took only 40 per cent of Venezuela's crude exports, while taking 50 percent of its heavy fuel oil and but 15 percent of its other refined products.

Consumption Is Expanding

Venezuela's domestic consumption of petroleum is undergoing tremendous growth in recent years, although it cannot yet be termed a particularly large user. Consumption in 1956 was half again larger than in 1954, two times greater than in 1952, nearly three times above 1949, four times more than in 1948, and eight times bigger than consumption in 1946.

During 1956, Venezuela consumed an average of 123,412 barrels of refined oil products daily. This was 17,100 barrels, or 16 percent greater than consumption in 1955.

Additional growth in domestic consumption will take place. A vast highway construction program will encourage the use of more automobiles and trucks, and as the country's general economic progress reaches higher levels more people will be able to afford cars. Great expansion of the country's agricultural business is being accomplished by increased use of tractors and other mechanized farm equipment. Sharp growth in industrial activity will also be an important factor in creating a larger market.

Heavy fuel oil made up nearly half of Venezuela's 1956 oil consumption, gasoline one-fourth, and gas oil and diesel oil one-sixth.

Consumption of heavy fuel oil totaled 59 million barrels least year, almost ten times more than in 1946 and more than double the quantity consumed five years ago. Gasoline consumption of 32 million barrels was over five times larger than ten years ago. The consumption of gas oil and diesel oil was 13 times larger than ten years ago, and nearly three times above five years ago.

Consumption of Refined Oil Products in Venezuela

Barrels Per Day

YEAR	Total	Gasoline	Kerosine	Gas Oil Diesel Oil	Fuel Oil	Other
1944	11,062	3,309	1,070	861	5,629	193
1945	12,590	4,192	1,277	1,169	5,485	467
1946	15,655	6,001	1,540	1,491	6,183	440
1947	26,184	8,112	2,002	3,409	11,993	668
1948	31,960	10,167	2,149	5,018	13,796	830
1949	43,660	13,522	3,950	6,759	18,241	1,188
1950	51,518	14,828	4,653	7,437	22,826	1,774
1951	57,235	16,487	5,337	7,655	25,365	2,391
1952	61,673	19,264	5,917	9,452	25,076	1,964
1953	74,675	21,908	6,777	13,482	30,420	2,088
1954	89,931	25,179	7,461	15,003	40,001	2,287
1955	106,333	28,537	7,974	17,172	49,771	2,879
1956	123,412	32,152	8,521	20,272	59,161	3,306

Source: Venezuelan Ministry of Mines and Hydrocarbons.

—The End

Next Decade May Dwarf All Records

Optimistic outlook for oil industry supported by these trends and evaluations:

- **Only one exploratory test has been drilled for every 700 square miles of potentially productive oil and gas acreage in Northern Alberta.**
- **3600 completions forecast for Western Canada this year for another record.**
- **Major crude pipe line projects scheduled as current facilities operate at capacity.**

By G. S. MILLER

A DECADE OF unprecedented oil and gas exploration and development in Western Canada, touched off in 1947 with the Leduc discovery, drew to a close in 1956 but not without first chalking up records for the greatest year so far. Even with the tremendous strides already made, there are those who believe that the 700,000 square miles of potentially productive area have only been scratched and that exploration and development in the next ten years will dwarf previous accomplishments. And if the first five months of 1957 are to serve as any indication, the new decade is off to a flying start—for some activity already has eclipsed that for the same period in 1956.

Gross revenue for the more than 170 million barrels of oil produced in Canada during 1956 amounted to $400 million, compared with the $16 million for the year 1947. The 1957 figure is expected to pass the half-billion dollar mark and to become Canada's No. 1 source of mineral wealth. Although production reached an all-time high, new reserves were being added at 2½ times the rate of production. Natural gas that was being freed of its bonds in 1956, will account for huge expenditures on both development of new reserves and facilities for delivering it to Canadian and U. S. markets.

Further proof that exploration for oil and gas has only started in Western Canada lies in the fact that in the vast area of northern Alberta, only one exploratory hole has been drilled for every 700 square miles of

1957 Drilling Rates Expected To Spiral

DRILLING OPERATIONS in Western Canada have climbed sharply in recent years, and another new peak is anticipated in 1957.

WORLD OIL'S mid-year survey of Western Canada drilling prospects indicates approximately 3600 wells are likely to be completed during 1957. This is 291 more wells than the previous record of 3309 wells completed in 1955, a gain of 8.8 percent. Predicted 1957 rates are nearly 1/3 larger than the 2766 wells drilled in 1955, and 3½ times greater than the 1001 completions made during 1950.

Forecast of 17 million feet of hole during 1957 constitutes an 8 percent gain over 1956, 40 percent over 1955, and four times more than drilled in 1950.

These forecasts are based on survey replies from Canadian operators, who inform WORLD OIL how many wells they plan to drill during the year.

Second half drilling will need to result in the completion of 2144 wells to reach the level predicted for 1957. However, this seems reasonable, being only 2.1 percent larger than the 2099 wells completed during the last six months of 1956. Completion of 1456 wells during the first half of 1957 was 20 percent higher than the corresponding period of 1956. Due to better weather conditions, Western Canada traditionally completes substantially more wells during the last half of the year.

Western Canada drilling is being encouraged by high discovery success and rising production as new pipe lines provide access to markets.

An additional 475 wells are forecast for 1957 in Eastern Canada, where activity has been relatively stable for many years.

Forecast of Wells and Footage to Be Drilled in Canada During Second Half of 1957 and in the Year 1957

	WESTERN CANADA		EASTERN CANADA		ALL CANADA	
	Wells	Footage	Wells	Footage	Wells	Footage
Twelve Months:						
1957 Forecast	3,600	17,000,000	475	591,000	4,075	17,591,000
1956	3,309	15,742,982	451	561,002	3,760	16,303,984
1955	2,766	12,141,741	396	503,395	3,162	12,645,136
Last Six Months:						
1957 Forecast	2,144	10,123,677	....	.....	....	.....
1956	2,099	9,931,836	....	.....	....	.....
1955	1,681	7,440,645	....	.....	....	.....
First Six Months:						
1957	1,456	6,876,323	....	.....	....	.....
1956	1,210	5,811,146	....	.....	....	.....
1955	1,085	4,701,096	....	.....	....	.....

potential oil and gas land. In the Northwest Territory, the area widens to 7000 square miles for each wildcat.

It is estimated that only 10 percent of the exploration required to bring density of exploration up to that of the U. S. so far has been carried out in Canada. Around 19,000 wells have been drilled in Western Canada to discover and develop present reserves of 3.5 billion barrels of oil and it is estimated that 38,000 more wells will be drilled during the next 10 years.

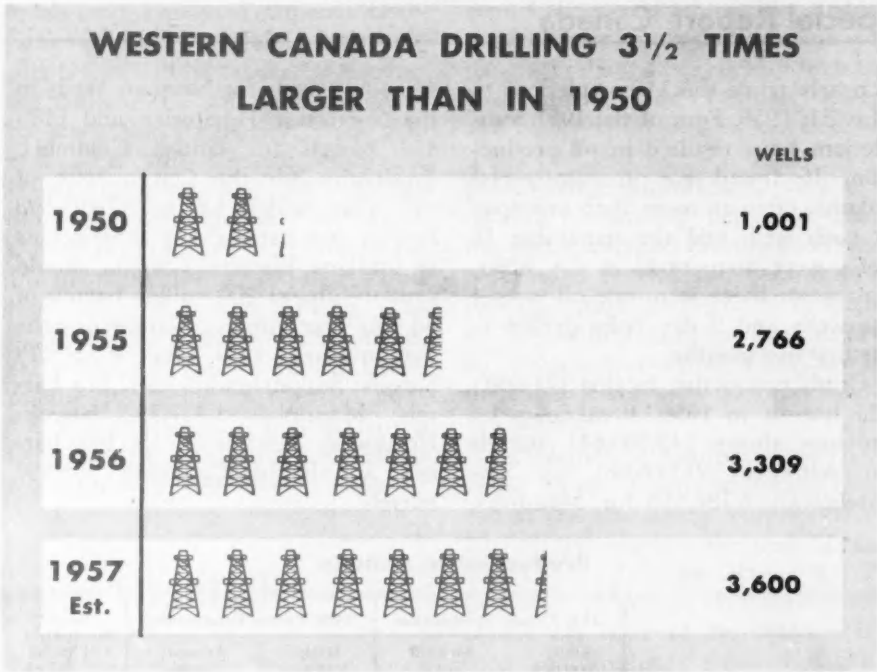
During 1956 drilling in the four Western Canada provinces and Northwest Territories accounted for 3282 wells, of which 2364 were oil wells, 184 gas wells and 734 dry holes. This compares with the 2766 completions a year earlier, of which 1914 were oil wells, 122 gas wells and 730 dry holes.

Footage during the year amounted to 15.7 million feet, up 2.8 million feet over the 1955 figure. Alberta accounted for almost two-thirds of the 1956 drilling, with 1892 wells completed for a total footage of 10,093,579 feet. In Saskatchewan, where operations in the southeastern part of the province resulted in an extremely high discovery ratio of light gravity oil finds, drilling activity was boosted to a new record high during 1956. There, 1099 wells were drilled for a total footage of 4.6 million feet.

Manitoba also was active, recording 254 wells drilled for a total footage of 603,919 feet. British Columbia, still in its infancy as an oil-producing province, but guaranteed a position as a gas supply area, saw the completion of 57 wells totalling 398,067 feet of hole. Northwest Territories accounted for only seven holes, with footage totalling 12,546 feet.

As a comparison, 1955 footage amounted to 12.1 million feet in Alberta; 2.9 million feet in Saskatchwan; 0.75 million feet in Manitoba and under 0.25 million feet in British Columbia and Northwest Territories combined.

Completions up to May 31, 1957 stood at 1113 wells, compared to 968 drilled in the same period last year. This year's completions show 725 oil wells, 60 gas wells and 328 dry holes. Last year, as of the same date, operators had drilled 708 oil wells, 40 gas wells and 220 dry holes. Saskatchewan recorded 427 completions in the first five months of 1957 compared to only 220 in 1956. Of this total 315 were oil wells, compared with 152 last year; one gas well this year compared with none last year; and 111 dry holes this year compared with 68 last year.



Some area suffers when budgets are limited and area of exploration is expanded and, as a consequence, for the first five months of this year Alberta operations were curtailed due to higher activity in other provinces. During the first five months of the year, 1957 completions totaled 550 for Alberta, compared to 663 last year. Of this figure, 341 of this year's wells showed promise of oil production, 43 were completed as potential gas wells and 166 were dry. In the comparable 1956 period, completions resulted in 502 oil wells, 49 gas wells and 156 dry holes. Another factor in the decrease in well completion rate in Alberta was the near-complete development of the huge Pembina oil field. With the field fairly well defined and 160-acre spacing pattern in a large section of the producing area, well completions in the field have dropped sharply for last year.

Manitoba from Jan. 1, to May 31, 1957, chalked up 95 completions and, in the first five months of last year, had only 71. This year's completions include 65 oil wells and 30 dry holes. Last year's tally was 53 oil wells and 18 dry holes.

British Columbia, like the province of Saskatchewan, has shown a large percentage increase in activity. With the advent of gas export in large volume later this fall, operators in this area were both developing present gas reserves and exploring for new gas fields. Numerous oil pools have been found in the prolific gas region to add incentive to the search.

The 38 wells drilled so far in 1957

Drilling in Canada

PROVINCE	WELLS COMPLETED IN 1956					WELLS COMPLETED IN 1955				
	Oil	Gas	Dry	Total	Footage	Oil	Gas	Dry	Total	Footage
Alberta	1368	138	386	1892	10,093,579	1145	109	342	1596	8,231,618
British Columbia	7	34	16	57	398,067	....	5	21	26	148,719
Saskatchewan	784	12	303	1099	4,634,871	522	7	294	823	2,896,718
Manitoba	202	0	52	254	603,919	247	....	70	317	755,978
Northwest Territories	4	0	3	7	12,546	....	1	3	4	8,708
Total Western	2365	184	760	3309	15,742,982	1914	122	730	2766	12,141,741
Ontario	57	157	217	431	513,884	48	143	188	379	475,973
New Brunswick	1	2	4	7	14,410	3	0	5	8	17,196
Quebec	0	1	12	13	32,708	0	1	8	9	10,226
Total Eastern	58	160	233	451	561,002	51	144	201	396	503,395
TOTAL CANADA	2423	344	993	3760	16,303,984	1965	266	931	3162	12,645,136

is nearly triple the 14 completions to May 31, 1956. Four of the 1957 completions have resulted in oil production, 16 found gas in commercial volume, often in more than one zone at each well, and the remaining 18 holes were abandoned as dry holes. Last year, there were one oil well, 4 gas wells and 9 dry holes drilled in the first five months.

Crude production totaled 171,360,925 barrels in 1956. Breakdown by province shows 143,909,641 barrels for Alberta, 21,066,881 for Saskatchewan, 5,786,540 for Manitoba, 449,409 barrels for Norman Wells in the Northwest Territories, and 148,454 barrels for British Columbia. Production for the first quarter of this year added up to 47,494,808 barrels and barring any drastic cuts in markets Western Canada should produce almost 200 million barrels of oil this year. Alberta's output for the first quarter, 1957 was 37,835,573 barrels; Saskatchewan, 7,947,313 barrels; Manitoba, 1,477,732 barrels; Northwest Territories, 130,193 barrels; and British Columbia, 103,997 barrels.

Production in Canada

PROVINCE	1956 Crude Production		1955 Crude Production		Total Producing Oil Wells at End of 1956
	Daily Average (Barrels)	Annual Total (Barrels)	Daily Average (Barrels)	Annual Total (Barrels)	
Alberta	393,196	143,909,641	305,025	111,334,000	7,390
British Columbia	406	148,454			7
Saskatchewan	57,560	21,066,881	30,236	11,036,000	2,412
Manitoba	15,810	5,786,540	11,501	4,198,000	736
Northwest Territories	1,228	449,409	1,107	404,000	62
Total Western	**468,199**	**171,360,925**	**347,868**	**126,972,000**	**10,609**
Ontario	1,621	593,287	1,466	535,000	1,422
New Brunswick	45	16,628			54
Quebec	0	0	0	0	0
Total Eastern	**1,666**	**609,915**	**1,466**	**535,000**	**1,476**
Total Canada	**496,866**	**171,970,840**	**349,334**	**127,507,000**	**12,085**

Major Pipe Lines Provide Market Outlet

Construction of both of Canada's big-inch natural gas pipe line began in 1956. Westcoast Transmission Company with a permit to export began early construction of its line from northeastern British Columbia to Vancouver and the Northwest U. S. Much of the construction season had passed before the Dominion Government was able to sanction construction of the Trans-Canada pipe line and then, hampered by a U. S. steel strike, this line was barely started before winter operations stopped all activity.

Westcoast, as of mid-June, had 85 percent of its 650-mile line completed and with just 75 miles of line to lay by the end of June, was about three months ahead of its gas delivery deadline. Already, this firm is planning on doubling its main line and is looking to other gas supplies in southwestern Alberta to meet fast increasing gas demands in both Canada and U. S. Trans-Canada construction is well advanced on the western section of the line and construction will start on the eastern leg to Montreal in July. The rough terrain north of the Great Lakes has caused some slowdown in operations but recent increases in manpower should push the line to completion by 1958.

Crude Lines at Capacity. The two existing oil transmission lines that go east and west across Canada out of Edmonton, Alberta, both were working at capacity during 1956. A major extension of Interprovincial Pipeline, from Sarnia to Toronto, will be completed by fall of this year. Looping and other construction plans of Trans Mountain were scheduled to increase its capacity of 200,000 barrels daily to 240,000 barrels per day by August. Plans were to fully loop this western line and work toward an ultimate capacity of 600,000 barrels daily.

Many short feeder lines from Alberta and Saskatchewan fields were added to the ever-expanding transportation system during the year and more are planned and being built in 1957. By the end of 1956, Canada's total pipe lines added up to around 5700 miles and, with the major gas lines under construction and feeder lines for those gas systems as well as oil feeder lines, this figure should be boosted to 9000 miles by the end of 1958.

Drilling operations reached a peak in July and August last year, when more than 300 rigs were on the active list. The August record of 304 active rotaries had 185 engaged in Alberta operations, 120 on field wells and 65 on wildcats; 89 in Saskatchewan, 61 field and 28 wildcat; 11 in Manitoba, divided 8 and 3 as to field and wildcat; 18 in British Columbia, with 10 on field wells and 8 on wildcats and 1 on a wildcat in the Northwest Territories. The first week of June this year showed 260 rigs working, with 140 operating in Alberta, 83 in Saskatchewan, 14 in Manitoba, 22 in B.C. and one in the NWT.

Geophysical exploration operations were running about 10 percent below last year and, as of June 1, 1957, 101 seismic and gravity crews were active. Last year, at the same time, 112 crews were searching for drillable prospects. Seventy-one of the west's active crews were operating in Alberta, including 68 seismic and three gravity parties. Saskatchewan had 23 seismic parties in the field. Six crews were at work in British Columbia and one crew was active in Manitoba. No geophysical crews are operating in the Northwest Territories. Last year, the 112 active crews included 82 in Alberta, 21 in Saskatchewan; 8 seismic crews in B. C.; and 1 crew north of the 60th parallel in NWT.

British Columbia recorded seven significant gas discoveries during 1956. In the initial five months of this year, increased drilling activity resulted in five new oil discoveries, or sizable extensions, and two gas finds. Accurate data on the discoveries' potential is scarce and, in most cases, single strikes have not been followed up by evaluation wells.

Three of the five wells classed as 1957 oil discoveries were in the general Boundary Lake area, where the province's largest proven oil field is situated. The other pair of oil discoveries for this year were made at wells in the Milligan area by the Hudson's Bay-Union Oil team; and at Stoddard Creek by Pacific Petro-

leums. The Milligan oil discovery in the Basal Triassic zone is 52 miles north of Fort St. John and 35 miles north-northwest of Boundary Lake Triassic oil field. Pacific Petroleum's newest oil strike at Stoddard is about 20 miles northwest of Fort St. John in an area already proven for gas production.

Oil discovered in British Columbia presently is tied to a very limited market in the immediate area and was being refined at the province's only refinery at Dawson Creek, which can handle about 2000 barrels of crude daily. A second refinery was under construction by Pacific Petroleums and Phillips Petroleum Company at Fort St. John. This new plant, that will be capable of producing airplane fuel will more than double the refinery capacity of the general area; will displace shipped-in refined products, and will add another economic outlet for British Columbia's growing oil production. Initial plans for a 400-mile crude pipe line west out of Fort St. John to the Pacific Coast were announced early this year, but the project would require producing capacity of 100,000 barrels daily and present output from the 14 completed oil wells is approximately 3000 barrels daily.

Granite Wash Discovery a Highlight

When oil flowed to surface during Granite Wash drillstem tests at Union Oil Company of California's Red Earth Creek No. 12-17 wildcat, it indicated the best Granite Wash oil discovery to date in Western Canada. It sparked a land play that resulted in the filing on more than 30 million acres of government lands in Alberta and Saskatchewan. Both the area of discovery, a remote spot in northwestern Alberta about 80 miles east-northeast of Peace River town and 210 miles north-northwest of Edmonton, and the time of the strike, February of 1956, were against fully evaluating the find. The operator due to weather and terrain was forced to move out of the region after drilling one unsuccessful stepout test and was not able to resume exploration until the fall of the year.

Follow-up drilling in the winter months of 1956 and 1957 resulted in three more oil successes to further prove the find as the most significant of last year. Along with the four oil wells, Union drilled five exploratory dry holes in its attempt to quickly evaluate its huge spread of oil and gas reservation rights, which include 14 separate reservations covering almost 2 million acres. Drilling and production operations in the region again were curtailed last spring.

The discovery firm, with so much at stake in its large acreage spread, recently moved a rig back to the area to attempt a six-well drilling program for this summer. This project involved the building of high quality all-weather roads.

Zone Established. The Red Earth discovery well did more than any previous Granite Wash oil discovery to establish the zone as another potentially large producer of oil in Western Canada. Follow-up successes were drilled one mile east, two miles northeast and four miles north-northeast, all by Union of California. The Wash at the Red Earth 12-17 was contacted at around 4750 feet and is more than 50 feet thick. On production test, it produced light gravity oil at a rate of 1584 barrels daily. Transportation of oil to market was a problem as the field lies 80 miles from road and rail facilities, but if sufficient reserves were discovered, a 130-mile pipe line to connect with the Peace River oil pipe line at Sturgeon Lake would be feasible. Adding to the feasibility of the pipe line was the fact that other fields, such as Normandville and Iroquois River, also could be serviced by the line.

Large Wall Map of Western Canada

A detailed multi-colored oil and gas map of Western Canada has been inserted in copies of this issue going to subscribers in Canada, New York, New Jersey, District of Columbia, and outside the U. S.

Other subscribers may obtain one free copy of the map by using the blue Reader Service Card at the back of the issue. A space has been provided to request a copy.

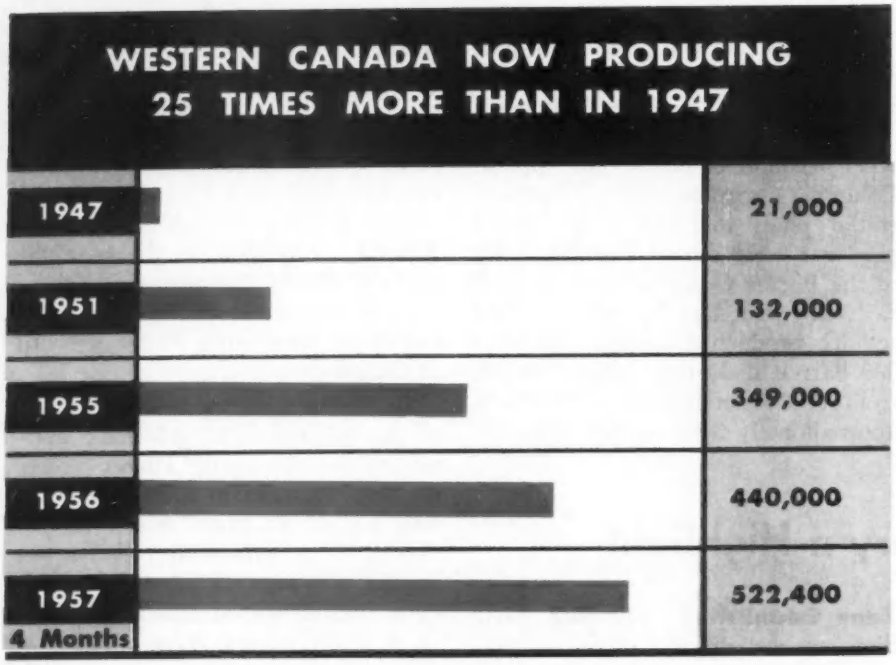
Discoveries Significant. Southern Alberta, somewhat neglected since the Devonian and Cardium oil discoveries of central and central west Alberta, came back in the spotlight in 1956 with a discovery well drilled by Texaco Exploration Company in the High River area 35 miles south of Calgary.

In addition to finding an oil show in the Mississippian, producing horizon at the now-aging Turner Valley oil field 16 miles to the west, Texaco's C. & E. High River A-1-25 flowed oil to surface on drillstem test in the D1 zone of Devonian. This zone had produced small quantities of oil in the general Edmonton region but had not produced oil commercially in the southern sector of the province.

The pay zone was perforated in the interval 9625 to 9638 feet for production test, and flow rate was measured at 326 barrels per day through a $^{22}/_{64}$-inch choke. Although the discovery was made in October of last year, the operator just spudded its initial follow-up test late in May of this year and, as of July 1, the company was drilling below 8125 feet, with around 1500 feet to go to its main objective. This follow-up is situated three-quarters of a mile southeast of the A-1-25 D1 oil find. The Mississippian at this second well gave some indications of gas success.

New Cardium Field Promising. The Keystone, Cardium sand zone oil field, discovered in October, 1956, by Canadian Cities Service Petroleum Corporation was developed to a sizable field in the past six months, now boasting 21 wells capable of production. Lying ten miles east of the eastern proven limits of the huge Pembina oil field the field is traversed and served by the Pembina Pipe Line.

The Cardium pay sand is found at around the 4000 foot level, above the Pembina field average of 4900 feet, and completions have rated initial potentials in the 500 to 1000-barrel-per-day class. Average pay thickness is about the same as at Pembina, but porosity and permeability are better. Gravity of oil is 35.



The discovery firm currently has four rigs working.

The Cutbank River region also indicated production from the Cardium sand formation during the year, but in this virgin territory—50 miles south of Grande Prairie, 230 miles west of Edmonton and 120 miles north-northwest of the summer resort of Jasper—muskeg conditions make summer work impossible and, therefore, most of the discoveries themselves remain to be evaluated. Little follow-up exploration work had taken place. Bailey Selburn Oil & Gas, Ltd., discovered light gravity oil at its Cutbank East 16-4 wildcat, in November, 1956. Nearest Cardium production to this single wildcat is in the Pembina field 180 miles southeast.

Wildcats Lead to Significant Finds

Wildcatting operations in Alberta during the first five months of 1957 resulted in 32 oil and/or gas discoveries as compared to 44 for the same period in 1956. However, what the discoveries have lacked in quantity, it appeared they may make up in quality. This year, 16 oil and 16 gas discoveries were made in the initial five months, while last year 16 oil discoveries and 28 gas discoveries were chalked up. Several significant oil discoveries, important by themselves but not yet fully evaluated, were recorded by Phillips Petroleum Company of Oklahoma at Kaybob and Home Oil Company and associates at Virginia Hills and Swan Hills. All three strikes were in the same general area of the province and all yielded oil in apparent commercial volume on drillstem tests from the Slave Point section of the Middle Devonian. This zone had not previously produced in commercial quantities in the province.

Virginia Hills—Swan Hills Discoveries Important. First of the three discoveries was made by Home and Associates at their Virginia Hills 9-20 wildcat, 120 miles northwest of Edmonton. Home followed up this discovery with a second discovery in the same zone at its Swan Hills 8-11 test, 25 miles northeast.

The whole of the industry following the play closely was hopeful that the two discoveries might be tied together. The company stepped-out six miles to the northeast of its Virginia Hills 9-20 well and drilled a dry hole, which took some of the edge off the discoveries. But the two successful wells still must be ranked as one of the hottest prospects in Alberta during the past few years. Production tests have been delayed by road conditions in the region as has the team's second follow-up six miles southwest of the Swan Hills 8-11.

On drillstem tests at around 9200 feet, at Home-Union-Hudson's Bay Virginia Hills 9-20 large recoveries of light gravity oil were recorded. The same Slave Point formation was contacted at the 7850 foot level at the Home-et al Swan Hills 8-11 and a 2400-foot oil recovery (that graded at 40 gravity) showed on the single drillstem test.

The Home group's first discovery was made in February and had hardly recorded their second successful wildcat in early March, when Phillips Petroleum Company drew the industry's spotlight to its Kaybob 1 wildcat, 34 miles west southwest of the Home Virginia Hills discovery.

Phillips' Kaybob 1 wildcat flowed oil to surface on initial drillstem test in the Slave Point and, on subsequent tests 9500 to 9600-foot interval flowed oil at rates up to 110 barrels per hour. The operator cored and tested 115 feet of Slave Point oil pay zone. This discovery well recently was completed drilling at total depth of 10,445 feet, and Phillips was preparing to make a production test of the discovery horizon. A second well, Kaybob B-1, 4½ miles east of the initial discovery was to be drilled immediately.

Waterton Park is Major Gas Discovery. Shell Oil Company's early 1957 discovery of gas in the Mississippian at its Waterton Park 1 wildcat, 20 miles north of the U. S. boundary and ten miles west of Pincher Creek gas field, was rated as a major gas reserve discovery. It was followed by discovery of gas in the same zone by Texaco Exploration Company at its Castle River A-3-4 wildcat. The Texaco find is ten miles north and slightly west of Shell's Waterton discovery.

During production test of the Shell Waterton well, following acidization of the Mississippian between 11,322 and 12,110 feet, a gas flow rate of 6 MMcf daily was recorded along with 30 barrels of condensate per million feet of gas. The Texaco Castle River discovery had yet to be production tested. Follow-up wells were started by both Shell and Texaco.

Other gas producing areas in the province also have gained in importance as Trans Canada and West-

coast Transmission approach the time when they will start taking gas to markets. Requirements of these two main lines, plus talk of a third export line in the not-too-distant future, will mean rapid re-opening of the many gas fields made idle in past years by lack of market, and will mean a quicker outlet for new gas discoveries such as Waterton, Castle River, Savanna Creek, and even Whitecourt in west central Alberta a few miles north of the huge Pembina oil field.

Alberta Development Reaches Peak

The Pembina oil field of west central Alberta, lying 65 miles southwest of Edmonton and covering an area of almost 600 square miles, saw its most active development in 1956. This Cardium sand oil field, which is the largest field, area-wise, in North America, was discovered by Mobil Oil of Canada, Ltd., in 1953. As of the end of last year, it boasted a total of 2680 oil producers, and 177 more successes were added to that number during the initial five months of this year.

Although the field limits had not yet been defined to the east and north, secondary recovery projects for the area already were well under way. In November 1956, the first water injection into the formation in this initial system was carried out by Canadian Seaboard Oil Company and associates. And since that time, other major producers in the area—Pan American Petroleum Company and Mobil Oil, discoverer of the field—have instituted their recovery projects. Primary recovery methods likely would have produced 520 million barrels of oil over an approximate 20-year period. But under secondary recovery methods, it is anticipated ultimate recovery will be increased to well over 1 billion barrels. Cumulative production from the field to the end of 1956 was just over 49 million barrels and during 1957 daily average output was in excess of 100,000 barrels.

Drilling operations in the field have decreased considerably since last year, but the area is expected to account for about 600 completions. In addition to actual drilling and production activity, the previously mentioned waterflood systems, a gas gathering system for the entire field and additions to existing oil gathering lines were expected to make the field the most active area in Alberta during the current year.

Oil Changes Saskatchewan's Economy

The oil industry in Saskatchewan made greater advances than in any of the other three western provinces in 1956, changing the entire economy of that province. Revenue from crude oil did not displace agriculture as the main source of income within the province, but it did top all other mineral resource sources. The southeast sector of the province recorded a discovery rate of one successful well for every 1.8 wildcats drilled. Not all of these discoveries resulted in commercial oil production, but a significant number did. About 40 discoveries were recorded in 1956. Drilling activity climbed to a record peak of almost 90 active rigs in the summer months and oil wells were being completed at the rate of almost two per day.

Development commitments caused by the high discovery rate of 1956 kept at least 75 percent of all Saskatchewan activity confined to the southeast corner of the province.

Saskatchewan's 1957 Activity Impressive. Despite very unfavorable operating conditions during winter months, Saskatchewan started off the new year of 1957 where it had left off in 1956, and new drilling and production records soon were established. The 1956 discovery ratio was too good to last, and 1957 operations so far have not resulted in as many oil finds. This fact has slightly dampened some of the more optimistic operators, exploration operations were continuing.

Canadian Crude Oil Reserves
(In Thousands of Barrels)

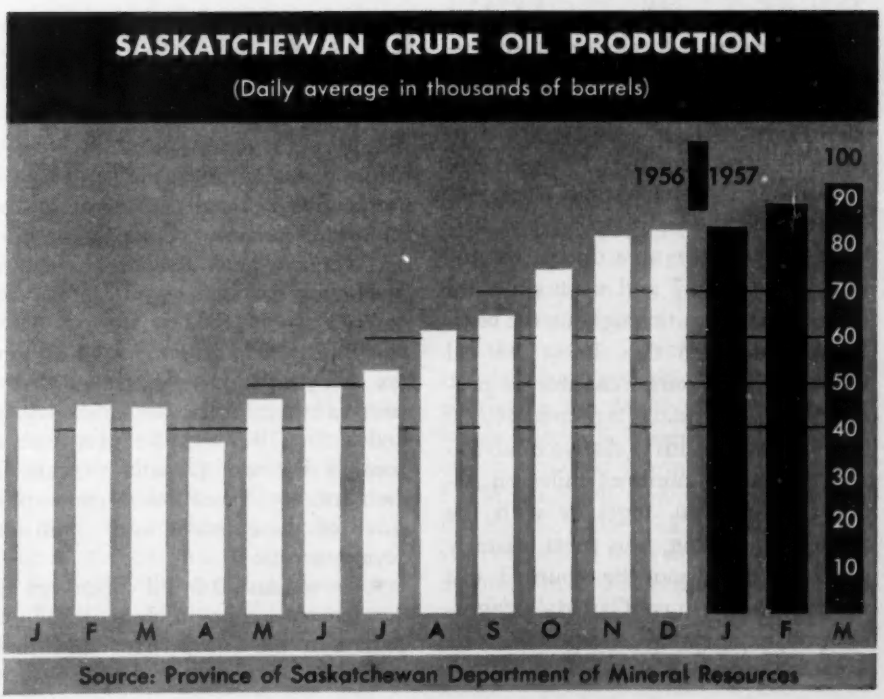
PROVINCE	Reserves as of Dec. 31, 1956	Reserves as of Dec. 31, 1955	Reserves as of Dec. 31 1954
Northwest Territories	53,258	53,707	26,172
Alberta and British Columbia	2,391,778	2,169,985	1,928,479
Saskatchewan	358,693	236,872	222,365
Manitoba	42,005	45,211	29,127
Ontario and New Brunswick	3,636	3,759	1,471
Total	2,849,370	2,509,534	2,207,614

Amazing growth of Saskatchewan's crude oil production during the past 12 months is graphically portrayed by this chart. Note that since March, 1956, production has more than doubled.

In the 12 months of 1956, total oil wells capable of producing leaped from 1644 to 2414. By the end of March 1957, this figure had increased to 2612.

An unusually high success ratio, easy drilling, high gravity crude and ready markets accounted for much of the increase in activity in the province.

Records of the first six months' operations in Saskatchewan showed 563



wells completed this year as compared to 326 in the same period of last year. In June, well completions totalled 136, just a few wells short of the record of 145 established in September of last year. The June score boosted the completion tally to 403 oil wells, 3 gas wells and 157 dry holes.

Discovery rate is a third lower than last year, with 14 oil strikes chalked up in the first six months of 1957 compared to 21 last year. A slight decrease in drilling activity was noted in the past month. With upcoming government sales offering proven acreage, it was anticipated that some of the idle rigs would be returned to operations later this year. Latest rig activity check showed 75 rigs in the province, about 80 percent of them in the southeast sector.

Manitoba Reports Shallow Area Drilling

Manitoba drilling operations in 1956 failed to develop any really significant oil strikes, but the southwest part of the province with its shallow comparatively easy drilling conditions accounted for considerable activity. About 250 well completions were recorded in the year, 195 of which showed promise of commercial oil production.

Wildcat drilling operations were extended farther east than ever before in an attempt to further evaluate the sedimentary basin lying to the east of the province's major producing areas in the general Virden region. This project added invaluable geological information, but failed to yield any commercial oil discoveries. The 1956 program was assessed by operators and was being carried out on a smaller scale during 1957.

Although the 1956 wildcatting work did not yield a great deal of encouragement, development operations showed fair success and this year operations in this phase are up slightly from last year. January to June 30, 1957, showed 127 well completions, with 83 oil discoveries and 44 dry holes. Twelve to 14 rigs had been working the area during the initial part of 1957 and were expected to remain active throughout the year. Production from the almost 800 oil wells in the province capable of production is running around 16,000 barrels daily. With a distance advantage of several hundred miles on Alberta production, together with the shallower drilling, the most easterly province could not be counted out as one of Western Canada's favorable oil exploration areas.

Drilling showed an increase in Ontario during 1956. By year-end 431 wells of all categories had been drilled as compared with 379 at the same time the previous year. Oil wells accounted for 57 completions, compared with 48 the year before; gas wells 157 compared with the previous year's 143. The 217 dry holes, compared with the previous year's total of 188, reflected the increasing tempo in wildcatting.

Crude production showed an increase during 1956. It amounted to 593,287 barrels (1621 barrels daily) as compared with 522,400 barrels (1427 barrels daily) a year earlier. Producing oil wells remained almost constant, however, with 1422 producing at year-end compared with 1433 at the same time the year before.

Activity in the St. Lawrence Lowland area of Quebec has been increasing and, since early this year, an average of six drilling rigs have been operating. Increased drilling activity by several companies was anticipated for remainder of the year.

Spurring exploratory work were three encouraging discoveries of gas within the past eight months. These were in rocks of Ordovician age located generally in the area north of the St. Lawrence River between Montreal and Quebec City. One of the discoveries, about 20 miles northeast of the city of Three Rivers, demonstrated a total open flow of 3500 Mcf per day.

One oil well and two gas wells were completed during 1956 and, at year-end, one well was drilling. Four dry holes were drilled last year. During 1956, a development project by an Oklahoma contractor was abandoned and, under terms of the contract, the completed wells reverted to New Brunswick Oilfields, Limited.

The contractor, during the year, completed four wells, one of which was a commercial oil producer. However, he was unable to meet the production commitment under the contract and abandoned the project on July 30, 1956. Production for 1956 totaled 16,628 barrels (45 barrels daily), for the province.

Reserves, Acreage Beckon Oil Industry's Interest

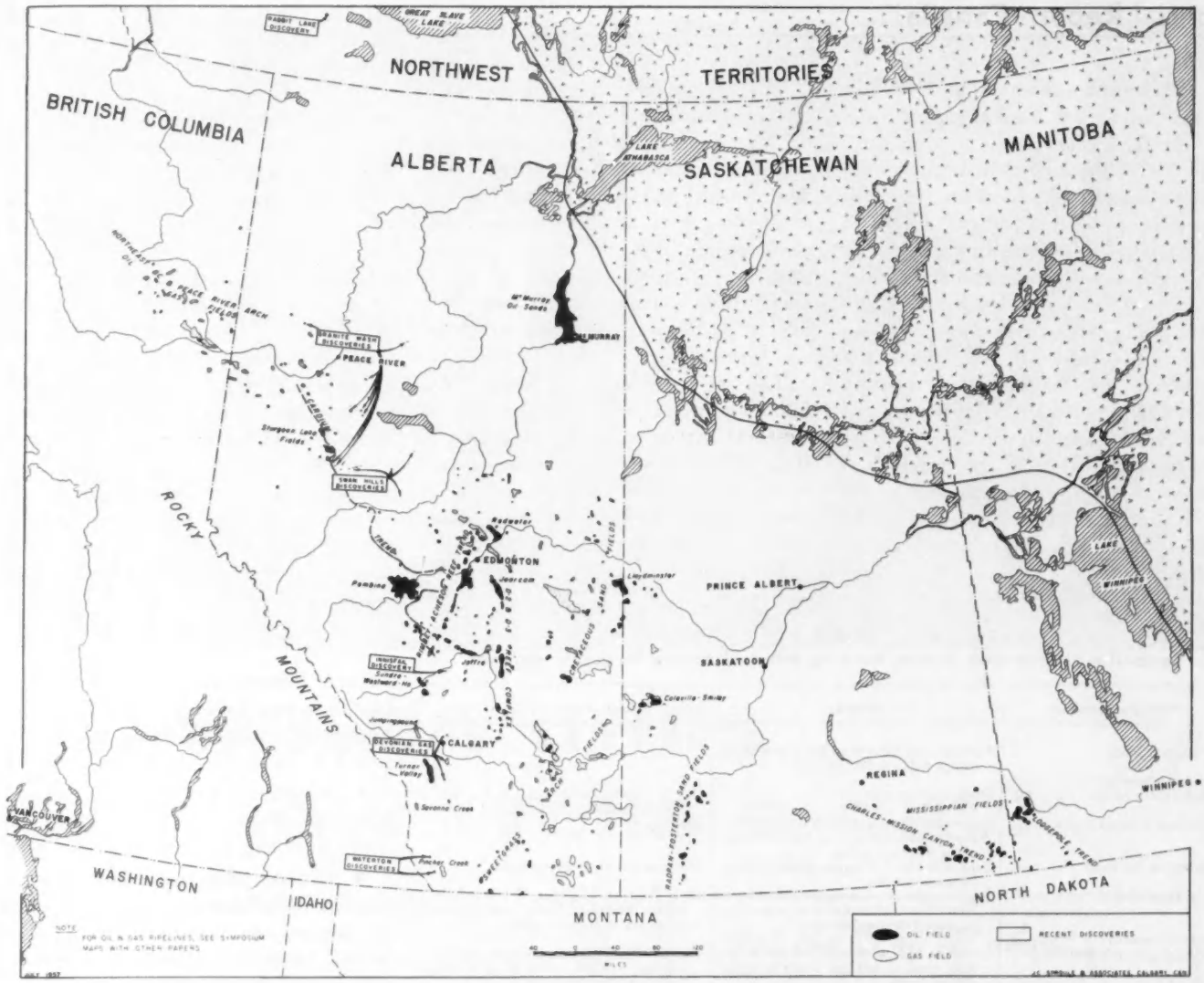
By DR. J. C. SPROULE

EXISTENCE OF major undiscovered crude reserves and availability of prospective acreage are two of the important factors comprising the current Canadian oil situation which is beckoning the interest of the oil industry in general.

Although a large number of oil and gas discoveries has been recorded—most of them since the discovery at Leduc in 1947—exploration operations in Western Canada still are in their infancy. Proof lies in the importance of these recent and significant developments:

- Devonian D-3 oil discovery in the Innisfail area in June, 1957, by Canadian oil companies and their partners.
- Slave Point oil discoveries in the Virginia-Swan Hills area by Home Oil Company, Ltd., and its partners.
- Wet gas discoveries in the Waterton area foothills by Shell Oil and Texaco Oil Companies in 1956.
- Devonian Reef gas discovery at Rabbit Lake in the southern part of the Northwest Territories, with Norman Wells Devonian reef oil in the northern part of the Northwest territories and with similar Devonian rocks, some with known seepages, from one end of the Mackenzie Basin to the other.
- Granite Wash discoveries in the Peace River Arch area.

It is of significance that these relatively recent discoveries were made



Interest is quickening across Canada's Prairie Provinces as more and more new oil and gas discoveries result from increased exploration activities.

at a time when many believed that the Redwater, Leduc-Woodbend, Rimbey, Fenn-Big Valley, Sturgeon Lake and other Devonian bioherm reef trends, the Joarcam, Joffre-Gilbey, Pembina and other Cretaceous sand trends, and the Mississippian biostromal reefoid trends in southeast Saskatchewan and Manitoba represented the larger reserves of recoverable oil in Western Canada. There is much evidence to the contrary.

The Innisfail discovery was made in an area that generally had been regarded as drilled up except for minor discoveries. Yet, 148 feet of oil-soaked D-3 reef was encountered, with every indication that a large reef exists.

The Swan Hills-Virginia Hills discoveries occurred in a region that previously had been paid scant attention and in a rock formation that previously produced by slight evidence of its importance as a reservoir of major proportions. Yet, the original Home Oil Company discovery of 40-gravity crude in the Virginia Hills area was followed by a second Home discovery 26 miles to the northwest, by the Phillips-Kaybob well 35 miles west of Home's discovery, and by the Mobil-Whitecourt well about 25 miles southeast of the original discovery.

The pay horizons are in reefoid Slave Point strata and the net pay in the four wells reportedly varies from about 27 feet to 100 feet.

Shell and Texaco Waterton area gas and condensate discoveries revealed the existence of other major fields, similar to the Pincher, Savanna Creek and Jumpingpound fields and give every indications of other Foothills and Rocky Mountain fields. A study of the pattern of the ranges of the Rocky Mountains and the understanding that, to a degree, this identical incipient pattern exists beneath the Foothills give indication that numerous competent Paleozoic block reservoirs in the Foothills await recognition and drilling.

Principal significance of the 1954-1955 Granite Wash discoveries is not so much that major reserves await discovery—although likely they do. Rather, it is that in the vast series of basins with widespread source rocks oil will have migrated by development of tension fractures into conveniently located source rocks. So, any of a large number of conveniently-located porous traps in the geological section could possibly become an oil pool.

Existence of Devonian reef occurrences throughout the Northwest Territories in the Mackenzie and Arctic basins naturally is significant. For the one oil field at Norman Wells and a 17 Mmcf open flow gas dicovery in the Rabbit Lake area both are in Devonian reefoid beds and are separated by more than 500 miles.

This northern area has been drilled but little, although exploratory geological parties currently are working

in the basins—from Alberta-British Columbia to the Alaska border, near the Arctic Ocean.

Table 1, showing principal geological horizons in which oil has been discovered up to the present, offers at least partial understanding of the potential these basins have for the future.

Table 1 and the known seepages and other indications show that oil and/or gas has been found from top to bottom of the geological column and over almost the entire length and breadth of these basin areas.

This, together with the limited nature of areas already evaluated, presages that Western Canada is in an early stage of exploration and development.

The only other ingredient necessary to the maintaining of the past discovery rate for an indefinite period is a continued interest on industry's part. And toward that end, about 600 oil companies with 221 exploration and development rigs, 99 seismic parties and an unknown number of other geophysical parties and surface geological parties are operating in Western Canada.

The oil industry spent about $2.8 billion between 1947 and the end of 1956. It still is spending money at a steadily increasing rate which currently is in excess of $600 million a year, exclusive of transportation, marketing and refinery expenditures.

Under the circumstances, considering the potential of the oil and gas basins, such an effort is bound to maintain a high rate of discovery.

TABLE 1
Composite Stratigraphic Section Showing Principal Known Producing Horizons

Producing Reservoirs	Remarks	Representative Fields
Tertiary:		
Paskapoo Sands	Paskapoo and Edmonton sands at shallow depths yield gas for farm use.	
Upper Cretaceous:		
Belly River Sands	Sands irregular.	Gas at Arvilla, Battle Lake, Leduc; oil in Pembina and Alhambra fields.
Solomon-Chinook Sands	Occur at or close to top of Wapiabi formation; a persistent zone in the lower part of the Alberta syncline.	Pembina.
Medicine Hat Sand	Sand near top of Colorado shale; contains large gas reserves.	Medicine Hat area; several fields.
Cardium Sand	Sand wedges out eastwards from Alberta foothills on west flank of Alberta syncline; important stratigraphic trap.	Oil in Pembina, Alhambra, Willisden Green, Rocky Mountain House and Keystone fields; gas at Huggett-Leduc.
Lower Cretaceous:		
Viking and equivalent Sands	Persistent zone in Alberta and Saskatchewan; most oil and gas occurs in stratigraphic traps.	Gas in Viking-Kinsella, Provost, Bindloss, Pendant d'Oreille fields; oil in Joarcam, Joffre, and Bentley fields.
Basal Colorado Sand	Developed only in southern Alberta.	Oil and gas in Cessford field; gas in Princess field.
Blairmore Sands	Sands irregular regionally, but locally important.	Several Lloydminster area fields; Fosterton, Bellshill Lake and Campbell oil fields; Princess, Morinville and Whitelaw gas fields.
Jurassic:		
N. Shaunavon Sands	Well developed in Saskatchewan.	Dollard, Gull Lake and North Premier oil fields.
Sawtooth Sands	Contain oil and gas in Alberta.	Conrad oil field; Manyberries and Goodwin Lake (?) gas fields.
Triassic:		
Sands and Dolomite	Particularly important in northeastern British Columbia and the Peace River area of Alberta.	Oil in the Boundary field of British Columbia and nearby wells in Alberta; gas in the Fort St. John, Airport and Charlie Lake fields, British Columbia.
Permo-Pennsylvanian:		
Dolomite	Small oil production, but important for gas in north-central Alberta; wedges out eastwards.	Belloy oil field; gas in numerous wells; several oil and gas fields northeastern British Columbia.
Mississippian:		
Rundle and related formations	Rundle in Alberta foothills supports largest gas fields and also important for oil.	Pincher Creek, Savanna Creek, Waterton and Jumpingpound wet gas fields and Turner Valley Oil and gas fields; large wet gas reserves northeast British Columbia; Sundre, Westward Ho and Harmattan fields; Many fields in southeast Saskatchewan and Manitoba.
Banff limestones and sands and Lodgepole limestone equivalent in Manitoba.	Banff sands produce heavy oil in Saskatchewan; Lodgepole yields almost all Manitoba oil.	Coleville oil field; Daly, Virden-Roselea and North Virden fields.
Upper Devonian:		
Wabamun Formation	Gas and oil in Alberta.	Okotoks and East Calgary gas fields; oil production minor.
Nisku Member	Gas and oil in Alberta; shows in Saskatchewan and Manitoba, but largely undrilled there.	Leduc-Woodbend and most other fields producing from reefs.
Leduc Reefs	Account for large part of Alberta's oil production and contain enormous wet gas reserves; reefs follow trends.	Redwater-Leduc-Woodbend-Bonnie Glen-Rimbey trend, Duhamel-Big Valley-Drumheller trend, Sturgeon Lake-Windfall trend.
Middle Devonian:		
Slave Point	Significant discoveries of oil and gas recently in central Alberta.	Swan Hills, Virginia Hills, Whitecourt and Kaybob areas.
Ordovician (?):		
Dolomite	Shows of oil in southeastern Alberta; prospective rocks in Saskatchewan and Manitoba.	Princess field.
Cambrian:		
Granite Wash	Granite Wash of Peace River area.	Gilwood and Red Earth fields.

Availability of Land. Now, what are the prospects for those who now have limited land holdings, or none at all?

Under existing land regulations in Western Canada, about one-half of the initially-issued permit acreage returns to the Crown, and it then may be re-issued in the form of leases, drilling reservations, P&NG reservations, etc. And it is possible that a given parcel of land may be re-issued several times without being evaluated as to oil and gas prospects.

In the more settled parts of Alberta, Saskatchewan and Manitoba, checkerboarded Freehold acreage blocks prevent present lease owners from holding their acreage indefinitely. The result is that Freehold acreage currently is becoming available.

Future Prospects. The largest part of the new oil likely to be found in Western Canada probably will be located in the following areas:

- Devonian reefoid and related horizons in central and northern Alberta and the Northwest Territories.
- Mississippian biostromal rocks in the Foothills and near Foothills areas of Alberta, in northeast British Columbia, southern Alberta, and southern Saskatchewan.
- Cardium and related Cretaceous sands in the form of pinch-out or combined pinch-out and structural traps.
- Jurassic, Triassic, Permo-Pennsylvanian and at several other horizons in northeast British Columbia, where the incidence of discovery per well drilled has been very high.
- Devonian and Silurian reefoid beds known to be present over large parts of southern Saskatchewan and Manitoba, where long-term prospects are good but where practically no oil has been discovered.
- In the Cambrian (Deadwood) and related sands of southern Saskatchewan and Manitoba, which have yielded only a few shows but evidence of a major reservoir.
- In the Granite Wash and equivalent sands throughout the areas discussed.
- In numerous other horizons which have proved fruitful in new areas and on presently unknown structures in old areas.

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Prospects Brightening For Burgeoning Gas Industry

By A. G. BAILEY

DEVELOPMENTS DURING the first six months of 1957 have completely changed the outlook insofar as exploration for and development of natural gas resources of Western Canada are concerned. Reasons for this are:

- During that period all financing required for Trans-Canada Pipe Lines Limited was completed and contracts signed for gas to meet initial requirements.
- Since the Trans-Canada position was clarified, other purchasers have suddenly appeared on the scene to establish a competitive market for the long dormant gas reserves.

Reserves of natural gas in Alberta at the end of 1956 may have amounted to as much as 30 trillion cubic feet. With discoveries made during the first half of 1957, they may range to more than 40 trillion cubic feet. British Columbia developments have been intensive, but no official overall estimate of reserves has been made of them nor of the reserves in Saskatchewan, where no major discoveries of gas have occurred to date.

Alberta Gas Trunk Line Company Limited has been incorporated to act as the grid system for the entire Province of Alberta with the exception of a small area in Northwestern Alberta which is served by Westcoast Transmission Company. Construction of this line now is under way and first gas will be turned into the grid system on July 23, 1957. If present plans for pipe lines to Eastern Canada and to the Western U. S. are completed within the next two or three years, Trunk Line will have a system of more than 1000 miles of main gathering line operating in the province.

Gas Drilling Upturn Expected. Naturally, many producers who have interests in or control of undeveloped gas reserves have been watching the efforts to obtain pipe line routes. Now that the pattern is beginning to come clear, these companies are making plans to develop many of their gas discoveries.

This will affect the drilling segment of the industry, the equipment and supply companies and all the auxiliary industries connected with such development.

Gas Contract Prices Increase. It is interesting to note the change of gas prices which has occurred during the past year. In the first contracts signed by Trans-Canada, the price was 10 cents at the field gate, escalating ¼ cent per year from the second year to 13½ cents in the 15th year. At a later date, Trans-Canada required additional gas for which it was willing to pay 12 cents; an increase of 2 cents over its first price with the same escalation. Early in 1957, West Coast Transmission was interested in contracting for gas reserves in the Southern Foothills area of Alberta and their price was 12¼ to 12½ cents at the field gate with much more favorable escalation features.

Still later, Pacific Gas & Electric Company appeared on the scene and had indicated offering prices at something better than 13 cents at the field gate. As can readily be seen, there has been a very quick increase in the offered price for gas in a relatively short period.

New Project. Plans to construct a $330-million pipe line system to transport gas from Canada direct to California were announced July 12, 1957, by Pacific Gas and Electric.

The project would connect the expanding California market to important new resources of natural gas in the Province of Alberta.

Reserves Increasing 10% Per Year. It has been the policy of the Alberta government to insist that sufficient gas reserves be dedicated for the Province of Alberta to meet their domestic requirements for 30 years before allowing export of large quantities of gas to other markets.

In 1956, the government estimated that the 30 years requirements for Alberta would be 7.6 trillion cubic feet. However, recent developments in the province would indicate that this figure is low and it probably should be something more in the order of 9.5 trillion cubic feet. During the same period, the gas reserves in the province have been rising approximately 10 percent per year. So the government will have further hearings to determine the total proven gas reserves in the province and to determine requirements of the province for the next 30 years.

Prospects. Producers are happy to see a firm market for their product coming up, of course. The original price offered by Trans-Canada was discouraging to the producers, but now that other buyers have appeared the producers are taking another look at their development program. All companies with either proven gas reserves or sufficient acreage along or adjacent to the routes of the proposed pipe lines are making plans either to intensify exploration efforts or prove up additional reserves in present known gas areas.

From geological indications, the biggest reserves should come from the Foothills belt or that area parallel to the Foothills from the Montana border to Northwestern Alberta.

This area presently includes fields such as Pincher Creek, Jumping Pound, Savanna Creek, Turner Valley, Pine Coulee, and Homeglen-Rimbey. Most of these fields are relatively deep and exploration is expensive. However, the reserves, when discovered, are tremendous and reservoir characteristics are excellent.

As an indication of the size of the reserves established in the Foothills, Pincher Creek has an estimated recoverable reserves of 1800 billion cubic feet; Jumping Pound, 538 billion cubic feet; Homeglen-Rimbey, 850 billion cubic feet; and Savanna Creek, 250 billion cubic feet.

In addition to the money which will have to be spent by the Trunk Line Company, more than $100 million will be spent by producing companies for exploration and development. And an additional $200 million will be required for various types of plants, such as absorption and sulfur plants and other processing plants.

Also, the tempo of drilling, especially in western Alberta, is expected to increase during 1958 and 1959 when developments of reserves for delivery in 1958, 1959, and 1960 will be required.

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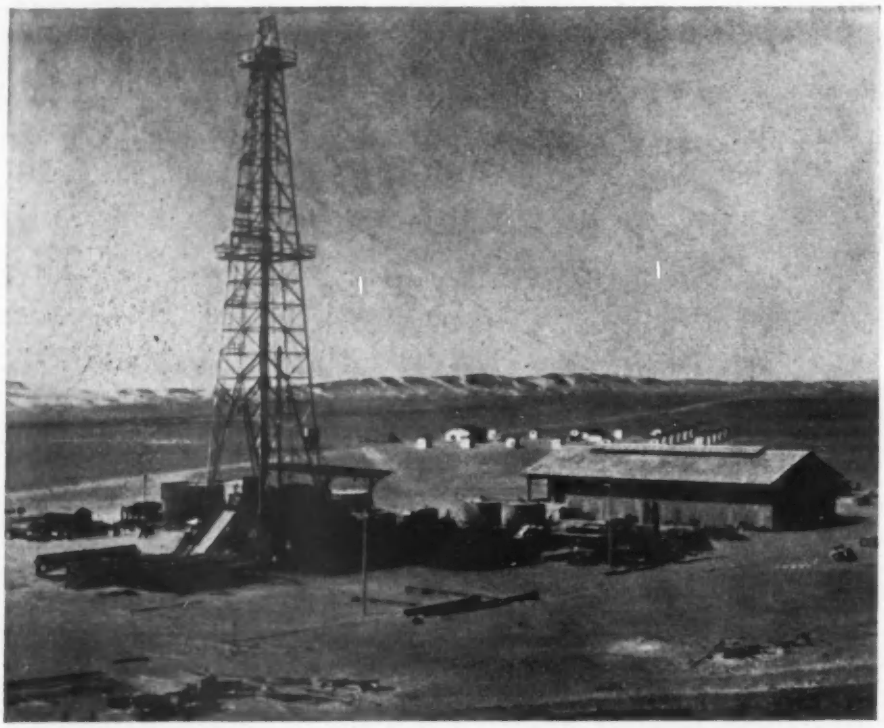

Photo courtesy Shell Petroleum Co., Ltd., London

This exploration well is located about 13 miles from Timimoun in the Algerian Sahara Desert. Air-conditioned accommodations for personnel can be seen in the distance.

Africa Looming as Potential European Crude Oil Supplier

Recent blocking of Suez underscores importance of continent's new discoveries as exploration, drilling and development operations continue apace.

AFRICA IS UNDERGOING a vigorous exploration, drilling and development boom as its importance as a potential oil source for Western European markets becomes more apparent. The recent blocking of the Suez Canal has made the prospect of African oil sources, particularly in the northern and western sections, of even greater significance to Western European nations dependent primarily on Middle East supplies.

In 1956 Angola became a significant producer of crude oil for the first time. This year, the first shipments of crude from French Equatorial Africa were sent to the mother country. Next year, it is likely that Algeria will begin deliveries of newly-found crude to France, a flow that may increase greatly in future years as greater reserves are found in the Sahara Desert and lengthy, large-diameter pipe lines are completed to transport the oil to Mediterranean ports for trans-shipment to Western European markets.

Despite increased drilling activity, Africa's production in 1956 declined to a total of 13,195,803 barrels, an average of 36,054 barrels daily, representing a 5.28 percent drop below the 1955 figure. The statistics are even more contradictory when it is considered that more than 92 percent of the 1956 Africa crude production total was represented by Egypt's production. And some of this production comes from fields on the Sinai peninsula, technically a part of Asia. The parts of Africa away from the Suez Graben, then, are the main areas of recent interest, particularly those in north and west Africa closer to Western European markets.

In North Africa, where thick sedimentary sections, primarily marine in origin, cover vast areas, particularly in Algeria, Libya, and Western Egypt, the remoteness and difficult terrain make operations difficult and require large-scale pipe line projects to get the new oil and gas out of the Sahara. However, the outlook is bright.

In many coastal areas of Africa and immediately offshore therefrom, more localized Cretaceous-Tertiary basins occur. In French Equatorial Africa, more than 100 salt domes have been reported. Two have been proven oil productive. Smaller reserves may be generally anticipated in such coastal basins than in North Africa because the aggregate volume of sediments is smaller; but coastal Africa has the advantage that the discoveries are closer to deep water and oil found can be more readily shipped out and marketed than that found in the Sahara.

Oil reserves have been established in such coastal basins in Angola, French Equatorial Africa and Nigeria. Natural gas reserves have been proven in the Cameroons. Oil and gas shows have been encountered in Senegal near Dakar, in western Madagascar and in Mozambique.

Any oil found in East Africa close to the Arabian peninsula might find competition with Middle East crude difficult; but oil discoveries in West Africa are in good position marketwise, not only for Western Europe but also for the Argentina-Uruguay-Southern Brazil consumer area as well.

And the vigorous oil exploration has its counterpart in the general awakening of the long-retarded African continent, now in progress. The rise of nationalism, long strides being made in medicine, education and industrialization all are apparent as Africa strives to emerge from the jungle.

According to the American Association of Petroleum Geologists' *Bulletin,* a total of 1,499,566 feet of hole was drilled on the African continent in 1956, twice the 1955 footage. Fifty-eight rigs were operating at the year's end. During 1956, 93 wildcats were completed, 16 of them as producers for a success ratio of 28.0 percent.

At the same time, 61 development wells were completed, including 48 producers, representing a 79 percent success ratio. Over all, 154 wells were drilled, including 64 producers for a success ratio of 57.8 percent.

Intensive surface geological work, core-drilling, and geophysical work took place. In all of Africa in 1956, there were the following party-months of exploratory work: surface geology, 461; seismograph, 445; gravity, 213; aerial magnetometer, 14; ground magnetometer 38; telluric, 14; structure drill, 94.

Algeria. Crude oil production decreased abruptly in 1956 to 239,012 barrels for a daily average of 653 barrels per day from the country's only oil field known at the beginning of the year, Oued Gueterini. The field is located about 65 miles southeast of Algiers and was discovered in 1949 by Societe des Petroles D'Aumale (SPA).

By the end of 1956, SPA had completed 188 wells at Oued Gueterini, which produces from Eocene limestone at 1100-1600 feet of depth. The field has produced more than 2.5 million barrels, but is being depleted rapidly. The production peak of 1740 barrels daily was reached in 1953, followed by a decline to 1575 barrels per day in 1954, and to 1189 barrels in 1955. The 1956 figure represents the first year since peak production was achieved that the output has dropped below 1000 barrels daily, last year's total amounting to a 44.9 percent decrease compared with 1955. SPA had 35 wells on production in 1956, and drilled only 9613 feet of hole, as compared with 35,538 feet in 1955.

During the same year that Oued Gueterini appeared to have entered its final stage, three new oil fields were discovered in Algeria, and at least four gas fields also were discovered.

Exploration by CREPS. Compagnie de Recherches et Exploitation de Petrole Au Sahara (CREPS), in which the Royal Dutch Shell Group owns a 35 percent interest, brought in an oil well gaged at the rate of 456 barrels daily during the spring of 1956. The discovery well was Edjele 101, located in the Fort Flatters area of the extreme eastern part of the Sahara desert in Algeria, only about two miles from the Libyan border.

The Edjele structure runs approximately north northeast-south southwest, and is at least ten miles long and three miles wide. A border commission has settled a possible controversy between Libya and Algeria, having found the Edjele structure to lie inside Algeria.

CREPS completed five wells on the Edjele structure during 1956, four of them as producers. Edjele 102, located 1148 feet west of the discovery well, was drilled to 2890 feet and tested salt water in the Visean (lower Carboniferous) pay zone discovered at about 1475 feet in Edjele 101. Estimated potentials of the four producers varied from 120 to 600 barrels per day of light 35-gravity crude. A second, deeper pay was found carrying gas, except in Edjele 103, where it bears oil. Many of CREPS' wells in the Fort Flatters area, including Edjele 101, are core tests.

At the end of the year, a second deep test, Edjele 2 was being drilled on the northwest flank of the structure, one objective of which was to locate any Devonian sands that might pinch out against the crest.

Tiguentourine. CREPS made a second oil discovery in the Fort Flatters area not long after the Edjele discovery. Tiguentourine 101 was spudded May 6, 1956, about 40 miles west of Edjele and found two pays—one flowing 25 barrels per hour at 1640 feet and the second flowing 38 barrels per hour at 2625 feet.

Tiguentourine 102, an east stepout, was spudded Sept. 25, 1956, and completed December 18 at a total depth of 2701 feet, productive in the lower pay. Another east stepout, 103, was being drilled with a light rig, and a full-hole rig was drilling a north extension at Tiguentourine 1 at the end of the year. it was expected that the Edjele and Tiguentourine structures would prove similar.

CREPS proved large indicated gas reserves during 1956, in vast concession areas in the Sahara centered about 300 miles west-southwest of Fort Flatters.

A pipe line at least 800 miles long would be needed to transport natural gas produced in the southern Sahara to the only immediately prospective market at Algiers. However, discovery of gas in CREPS' western permits also raised hopes of finding oil nearby.

In all, CREPS drilled 18 core holes and six deep tests in 1956, and was drilling three core holes and four full holes at the end of the year. Total amount of hole drilled during the year was 74,858 feet.

SN REPAL. Following the discovery at Edjele by CREPS, Societe Nationale de Recherches et D'Exploitation des Petroles en Algerie (SN REPAL) made a spectacular oil discovery at Hassi-Messaoud 1, a rank wildcat 63 miles southeast of Ouargla in a vast eastern Sahara area called the Grand Erg Oriental.

By November, 1956, the test had penetrated 459 feet of oil-saturated sandstone lying below Triassic-age salt. The pay horizon is either of Triassic or Permian age. No water was reported. Total depth of 14,508 feet was reached in January, 1957, and the well was plugged back and completed.

The oil found at Hassi-Messaoud is described as being light, sweet and with a gravity of about 35, similar to the crude found at Edjele and Tiguentourine. Reportedly, crude is being used at Hassi-Messaoud as fuel in rig diesels.

Hassi-Messaoud 1 was reported testing in early 1957 from 10,922 feet to 11,238 feet, flowing at the rate of 931 barrels per day on a 21/64-inch choke.

However, stepout wells drilled since Hassi-Messaoud came in have indicated that the discovery is a big one, in both vertical and horizontal directions. SN REPAL began drilling Hassi-Messaoud 2, located seven miles south-southeast of the discovery in February, 1957. By late June, this well was reported to have found oil in the same pay zone, topping the sand

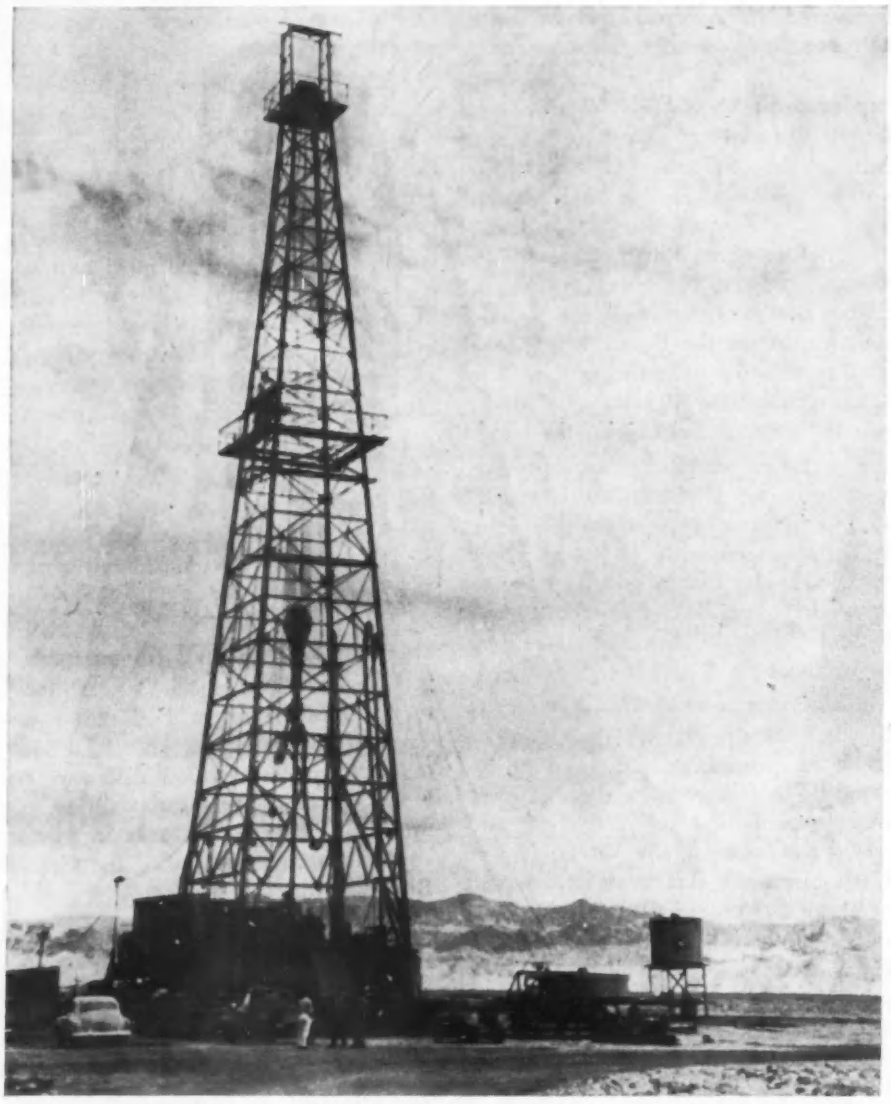

Photo courtesy American Petrofina Inc.

This National Petroleum Company of Egypt well is drilling ahead in the Belayim field.

about 200 feet deeper than in the first well.

Hassi-Messaoud 3, located about three miles northwest of the discovery, also was being drilled by mid-1957.

Talemzane. CFP-A made an earlier oil discovery, in 1956, at Talemzane, located 220 miles south of Algiers and about 180 miles northwest of Hassi-Messaoud. The test, known as Li 1, was spudded May 29, 1956, on the east edge of the Laghouat permit. Thirty feet of oil sand, roughly correlative with the Hassi-Messaoud pay, was cored from 8921-53 feet. The interval tested 100 barrels of crude with gas in six hours and fifteen minutes. A second well, located 1.2 miles north-northwest of the discovery, was drilling at the end of 1956.

Summary. The American Association of Petroleum Geologists Bulletin reported that a total of 888,000 feet of hole was drilled in Algeria during 1956, more than the entire footage drilled in all Africa in 1955. Ten development wells were drilled, including nine producers and one dry hole; 46 exploratory wells were completed, including three oil wells, five gas wells, and 38 dry holes. In all, 56 wells were completed, including 17 producers.

Pipe Line Projects. It is probable that sufficient crude oil reserves have been proved, both at Edjele and Hassi-Messaoud, to justify the construction of pipe lines to the Mediterranean, despite the high cost of such facilities. Six million dollars is to be spent by the French government to utilize existing railroad facilities from Philippeville on the Mediterranean coast to Touggourt, and to construct two ten-inch crude oil pipe lines, one 130 miles from Hassi-Messaoud to Touggourt, the other about 520 miles from Tiguentourine and Edjele to Touggourt.

In addition to a highly-accelerated drilling program to increase productive capacity as fast as possible, the French Government hoped to build 20-inch crude lines later from the main producing fields to Mediterranean ports in Algeria and/or Tunisia. The French hoped to be producing 100,000 barrels daily from Algeria by the end of 1958, to be increased to 200,000 barrels per day by 1960, and to 450,000 barrels per day several years thereafter.

Other Exploration. Several companies, including CPA, in which the Royal Dutch Shell Group has a majority interest, and CFP-A, conducted exploration in other parts of Algeria during 1956, without such tangible results as those described earlier.

In the Fort Miribel-Fort MacMahon area of the southern Sahara, CPA drilled a total of 41,295 feet of hole to test several lower Paleozoic prospects. In addition to the successful tests drilled by CFP-A on its Ouargla and Laghouat permits, there were several wildcats completed in the Grand Erg Occidental area. The company's 1956 footage amounted to 49,530 feet, according to data published by *Le Journal des Carburants.*

(See World Oil, April, 1957, page 235.)

Egypt. The Egyptian oil industry prospered generally during 1956 before Nasser's unilateral cancellation of the Suez Canal Company's franchise involved the nation in a short-lived war beginning in late October, which caused production and drilling activities to be suspended through the rest of the year.

Crude production, all of which is located along the shores of the Gulf of Suez in the Sinai peninsula and on the African shore facing Sinai, amounted to 12,174,335 barrels, or 33,263 barrels per average day in 1956. The 1956 total represents a 4.44 percent drop from the previous year.

Anglo-Egyptian Oilfields, Ltd., produced the majority of Egypt's crude

oil in 1956 with production of 8,922,651 barrels. Ras Gharib field, though its production declined from 1955, led with 7,209,356 barrels produced in 1956. Anglo-Egyptian also produced 1950 barrels from Gemsa field, and 260,146 barrels from Hurghada. Mobil Oil Egypt, Inc., reported a net production of 1,453,500 barrels, with 31 wells shut in at the end of the year due to hostilities. Mobil and Anglo-Egyptian jointly operated Sudr, Asl and Ras Matarma fields, which produced 1,808,890 barrels, 983,184 barrels, and 112,625 barrels, respectively, last year.

National Petroleum Company of Egypt, a fully-owned subsidiary of International Egyptian Oil Company, incorporated in Panama, with Petrofina, Ente Nazionale Idrocarburi, and certain Swiss circles each holding one-third interests, was second among producing companies in Egypt in 1956.

National Petroleum produced 1,798,184 barrels from 19 wells, 17 in Belayim and two in Feiran field. Rapid development of Belayim field continued with 11 wells being drilled there and completed as oil producers. Production from Belayim increased more than four-fold in 1956 to 1,586,145 barrels, as compared to 372,695 barrels the previous year. No new wells were drilled at Feiran, but there, too, production was boosted significantly, to 212,039 barrels in 1956 from 142,493 barrels in 1955. Including some wildcatting in the Suez Graben area, National Petroleum drilled a total of 83,692 feet of hole in 1956, as compared with 67,754 feet in 1955.

Transportation. Construction of facilities for transmission and shipment of National's crude has been completed. A 12-inch pipe line was built between Belayim and Feiran marine terminal, and a 13⅜-inch sea line has also been installed at Feiran, permitting loading of 13,500 deadweight ton tankers.

Further increases in production from Belayim and Feiran fields are expected in 1957. Seismic work was being continued along the Eastern Coast of the Gulf of Suez and in shallow water in the Gulf.

Seventeen wells were completed in Egypt during 1956, including four oil wells at Ras Gharib, and two dry exploratory holes drilled by Sahara Petroleum Company in the Western Desert. National Petroleum Company's drilling operations were renewed in February, 1957, and production began again in April.

Drilling at Belayim has indicated a major reserve, with 500 million barrels being estimated for reservoirs in the Miocene sands there.

In an apparent attempt to set up reparation claims against Britain owing to last fall's attack on Suez, the Egyptian government sequestered the properties of Anglo-Egyptian Oilfields, Ltd. Since Sudr, Asl and Ras Matarma fields are jointly operated by Anglo-Egyptian and Mobil Oil Egypt, Inc., the Socony company also was involved in sequestration.

Desert Exploration. In the western Desert area, Sahara Petroleum Company continued active exploration on a concession of about 90,000 square miles. Sahara Petroleum includes participation by Continental Oil Company, Richfield Oil Corporation, The Ohio Oil Company and Cities Service Oil Company.

Three seismic crews and three drilling rigs were active until the outbreak of hostilities at the end of October, 1956, when all operations ceased due to the attack on Suez.

Tests Encouraging. At a location at Burg el Arab, 28 miles southwest of Alexandria, Sahara was drilling a rank wildcat at the start of 1956 which was abandoned at 13,300 feet in deep basin facies on April 20, 1956. The well logged shows of dead oil in shaly Cretaceous limestones at 5170 feet.

A second rig was brought into Egypt by Sahara and a test was spudded in late January, 1956, at Wadi Natrun, midway between Alexandria and Cairo. This test was carried to 13,348 feet in sidetracked hole and abandoned after penetrating basement rock. The test nevertheless was encouraging in that a thick sedimentary section was proven at this location. A third test was spudded on June 12, 1956, at Mersa Matruh, near the coast not far from the Libyan border. The well was reported drilling at 10,364 feet at the end of 1956 and was abandoned at a total depth of 14,469 feet in June 1957.

Sahara has been assured by the Egyptian government that the current strong tendency toward nationalization and government participation in basic industries will not apply to or involve Sahara's operations.

A grand total of 127,169 feet of hole was drilled in Egypt in 1956.

Tunisia. Interest in Tunisian prospects dwindled in 1956 and 1957, continuing a trend of decline that began in 1954. The country's only hydrocarbon deposit found so far continues to be the small Cape Bon gas field, located in extreme northeast Tunisia, 30 miles east of Tunis, to which a four-inch pipe line transmits gas for industrial use.

No new drilling was reported at Cape Bon during 1956. Gas production was reported at 202,002 Mcf, or an average of about 552 Mcf daily. In addition, 8680 barrels of natural gasoline, or about 24 barrels per day, were produced with the gas. Gas production was up 29.12 percent from 1955's total of 156,445 Mcf, and natural gasoline production increased from 4895 barrels in 1955 for a 77 percent gain in 1956.

Production is operated by Societe de Recherches et D'Exploitations des Petroles en Tunisie (SEREPT). SEREPT was the only oil company active in Tunisia at the close of the year.

SEREPT drilled a total of 32,874 feet in 1956, as compared with 46,633 feet in 1955. Two wildcats were completed, and three others were drilling at the end of the year.

French Morocco. Despite vigorous efforts to develop new production in 1956, crude production in French Morocco declined, as it had in 1955 as compared with 1954. Societe Cherifienne des Petroles (SCP), the only oil-producing entity in Morocco, reported a total of 720,056 barrels for 1956, an average of 1967 barrels per day.

The concessions situation remained the same in 1956 and early 1957, with SCP holding 11,430 square miles (7,315,200) in French Moroccan concessions, comprising virtually all the area underlain by sedimentary beds. SCP drilled 21 wells during 1956, aggregating 113,384 feet of hole. Of these, 11 were exploratory wells; four were extensions, three of which were productive; five were development wells, with four resulting as producers and the fifth being completed as an injection well; and one core test.

Drilling. Despite the strenuous 1956 drilling program, it represented a de-

cline from 1955, when 39 wells and a total of 184,890 feet of hole were drilled.

Development drilling in 1956 negated the Mesozoic discovery reported in 1955 at ZR 11 well in the northwest Bled Khatara area. Wells ZR 10, 13, and 13bis were drilled to 7060, 6578, and 3358 feet respectively and failed to confirm the economic worth of the Zrar discovery.

In 1956, ten wildcats were drilled in the Rharb Basin, and one in the Sous Basin. A deep dry hole was drilled to 11,342 feet at Oued Rdom; another deep test near Petitjean (BA 7) was drilled to 11,361 feet; still another deep test at Sidi M'Barek, 25 miles east of Petitjean, MB 1, was drilled to 11,521 feet into Cretaceous below the overthrust plate without finding oil indications. The Petitjean area is locally thrust-faulted and broken up into small traps, hence the difficulty in finding economic oil accumulations.

It was reported that Ente Nazionale Idrocarburi, the Italian oil monopoly, was interested in entering French Morocco, and negotiations had been instituted by Enrico Mattei, ENI chief, with Sultan Mohammed V toward the establishment of a joint ENI-French Moroccan company to undertake exploration.

Libya. The intense scramble for concessions that followed enactment of the favorable Libyan Petroleum Law of June 19, 1955, appeared to settle down somewhat by the early spring of 1956, as many operators participating in the competition received permits along the prospective Mediterranean coast and began exploration plans.

If there was a lull, it was strictly short-lived and temporary, because Compagnie de Recherches et d' Exploitation de Pétrole au Sahara Edjele 101 well came in during late March of 1956 two miles west of the Algerian frontier in the Eastern Sahara. This discovery focused attention on the southwestern part of the Fezzan, which had been largely overlooked previously in favor of more accessible areas in coastal Cyrenaica and Tripolitania.

Libyan American Oil Company, a Texas Gulf Producing Company affiliate, was the first firm to drill in Libya. Libyan American spudded its Gerdes el Abid wildcat located near Benghasi on April 29, 1956. No shows were reported to total depth of 9372 feet. A fishing job halted operations at this depth late in the year, and the test was abandoned in January, 1957, without making any more hole. Like Sahara Petroleum Company's Burg el Arab well near Alexandria, Egypt, the Gerdes el Abid test found a very thick section of Cretaceous sediments. The rig was moved to another location at Ras Maraua.

Concessionaires. The following companies have concessions in Libya:

Nelson Bunker Hunt of Dallas; Esso Standard (Libya) Inc.; Mobil Oil of Canada, Ltd.; Libyan American Oil Company; Compagnie Francaise des Petroles; Texaco Overseas Petroleum Company, sharing concessions with California Asiatic Oil Company, a Standard of California subsidiary, on a 50-50 basis; Continental Oil Company of Libya; Amerada Petroleum Company of Libya; Oasis Oil Company, a subsidiary of Ohio Oil Company; Anglo-Saxon Petroleum Company (Shell interests); D'Arcy Exploration (Africa) Ltd.

Since both Edjele 101 and Hassi-Messaoud 1 discoveries have been confirmed in Algeria, Libya has granted concessions that block the western border of Libya solid from about 120 miles south of Edjele all the way north to Tripolitania, opposite the Tunisian border. Esso Standard, Libyan American, CFP, and Amerada have concessions facing Algeria.

As of the end of 1956, about 200,000 square miles of Libyan territory had been granted in concessions, approximating one-third of the national territory.

Exploration. Exploratory work was intensified. During 1956, there were 158 party months of surface geological work conducted in Libya, 24 of seismograph, 66 of gravity work, and four of ground magnetometer work. Land mines, planted during World War II along the Mediterranean coast and still live, continued to be a hazard and a nuisance to exploratory work, necessitating tricky and expensive detection and detonation chores before other work could proceed on the ground.

French Equatorial Africa. Societe des Petroles de L'Afrique Equatoriale Francaise (SPAEF) continued to develop the oil discovery made in 1955 at Ojouri, another at Point Clairette made in 1956, and to continue exploratory drilling in a West African coastal area in which over 100 salt domes are said to have been located. Two of them have been proven productive.

SPAEF drilled 69,448 feet of hole in 1956 and completed 17 wells. Four more were drilling at the end of the year. At Ozouri, 22 miles south of Cape Lopez on the (Atlantic) coast, five of nine tests completed on a shallow salt dome during 1956 showed for production and a sixth producer, OZ 10, was completed in February, 1957.

The prospect was located by reflection seismograph. OZ 1 tested 140 barrels per hour of 25-gravity oil from a 70-foot thickness of fractured Eocene chert at about 2100 feet. Salt has been found in three wells, above 3000 feet of depth. The pay thickness (chert) varies from 70 feet to 240 feet, and production varies from 35 barrels to 210 barrels per hour on ¼-inch chokes. Structure is very complex and a narrow fault block is being developed.

At Point Clairette, between Port Gentil and Cape Lopez, CL 1 was spudded June 16, 1956, and completed a month later. Substantial flow of gas was encountered in the Eocene below 2600 feet; in the Cretaceous, two oil zones were found between 3430 feet and 3610 feet which flowed at the rate of 126 barrels per hour.

Development proceeded rapidly. Five wells were completed at Point Clairette during 1956, and two more by early 1957, all of them producers. Clairette 2 tested 31-gravity crude at the rate of 157 barrels per hour from 3195 feet to 3248 feet. Another pay found from 3596 to 3672 feet tested 151 barrels per hour. CL 3 tested seven barrels per hour of 19-gravity oil from the Eocene, then tested 163 barrels per hour at 3947 feet in the Cretaceous. CL 5 found two pays in the Eocene and three more in the Cretaceous.

1957 Activity. Eight rigs were working during early 1957, two each in Ozouri and Point Clairette, the other four on wildcats, mainly between the two fields and south of Ozouri, where more salt domes were expected to be found. Increased gravity and seismic activity were planned. In addition,

core drilling operations to follow up gravity and seismic work conducted along the coast south of Ozouri toward the Belgian Congo were planned.

A crude oil pipe line to transport Point Clairette crude nine miles to Cape Lopez has been completed. In March, 1957, the first tanker cargo of Ozouri-Clairette crude—116,000 barrels—was loaded for shipment to Le Havre, France. Total 1957 production from French Equatorial Africa was expected to exceed 2.2 million barrels, or about 6000 barrels per cadendar day.

Nigeria. Royal Dutch Shell and The British Petroleum Company were somewhat encouraged by two oil discoveries made during 1956 in Nigeria. Shell-BP Petroleum Development Company of Nigeria Ltd. is the operating company, owned equally by both groups.

At Afam, 20 miles east of Port Harcourt, a wildcat tested oil and gas, and a second well, three quarters of a mile north of the first, was started late in the year.

At Oloibiri on the Niger River delta, three wells had encountered oil in three separate thin sands between 8000 and 9500 feet. Oloibiri 4, drilled during the first quarter of 1957, proved dry and appeared to establish the south limit of the field. The fifth well was being drilled in mid-1957.

Further north, a second well was drilled during 1957 at Akukwa, in Onitsha province, in hopes of finding oil associated with high-pressure gas that caused a blowout when the first well on this structure was drilled to 12,000 feet in 1955. However, this test also was reported dry.

At Ibotio in Calabar province, a wildcat drilled in 1956 encountered a thin oil sand. In all, five exploratory and four appraisal wells were drilled during the year, aggregating 60,000 feet of hole. Three drilling strings and four seismic parties were in operation during the year.

At Oloibiri, the three producers completed during 1956 and early 1957 are 3937 feet apart. The wells are located in an area of very difficult accessibility in the Niger delta. Shell-BP announced plans for construction of a 10-inch pipe line from Oloibiri to Port Harcourt for production testing. The line may not be permanent.

Marine Survey. A brief marine survey was done in November to gather data pertinent to possible oil exports from Nigeria by tanker. Calabar, Port Harcourt, and Lagos permit ships of 18, 21 and 25 feet of draft, respectively.

In mid-1956, Shell-BP announced that a new $3.5 million drilling barge had been ordered with a landing deck for helicopters and all auxiliary floating craft and equipment for operations in tidal swamps along the Niger delta coast. The barge was being built in a shipyard at Rotterdam in The Netherlands. It will mount a rig capable of 12,000 feet depth. Due for arrival in Nigeria in October, 1957, the new rig's first location was likely to be in the New Calabar River estuary near Krakrama, in Degema Division, about 20 miles south of Port Harcourt.

Also in mid-1956, Shell-BP announced a new wildcat location for a 10,000-foot test 16 miles south of Benin City, midway between Lagos and Port Harcourt, near the Ossiomo River. This is a seismic prospect. In 1954, a well northwest of Benin City found a non-commercial oil show at 6387 feet.

Angola. Angola became a significant oil producer in 1956 for the first time. Companhia de Combustiveis do Lobito, a Petrofina affiliate, produced 62,400 barrels during the year, for a daily average of 171 barrels. However, production did not start until mid-year, and only two wells, both flowing, were produced.

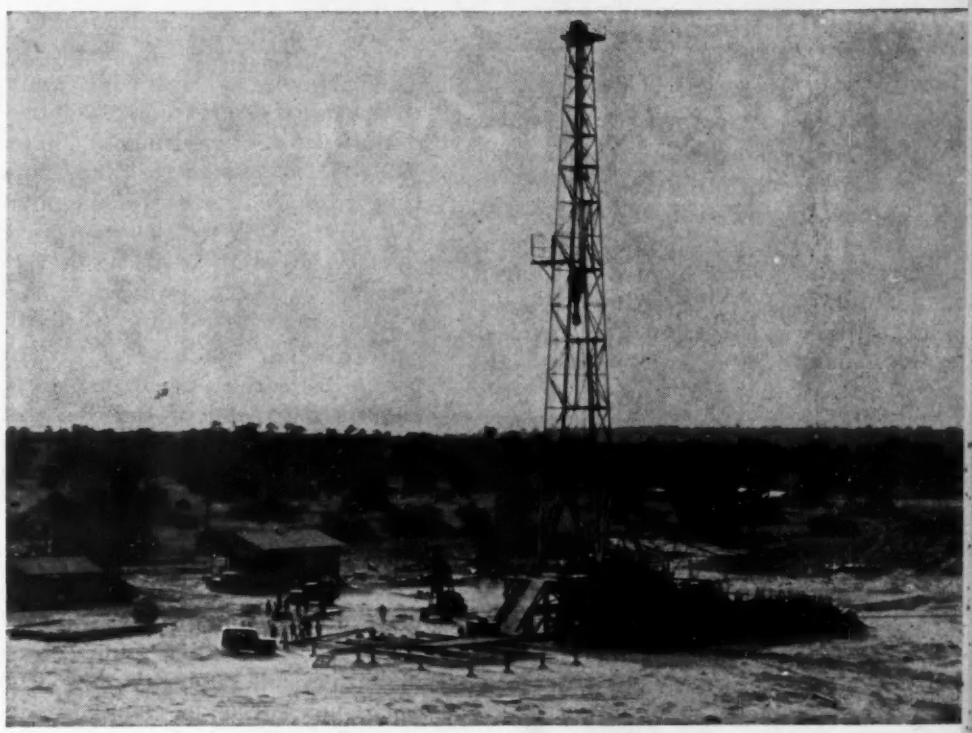

Photo courtesy American Petrofina Inc.

This Cia. de Combustiveis do Lobitos drilling rig is seeking production in the fractured limestone at 8400 feet in Angola.

A second discovery in Angola was made in 1956, following the discovery at Benfica, 30 miles south of Luanda near the coast, in 1955. There, fractured Cretaceous limestone at 8400 feet tested 200 barrels per day of light crude from the discovery well, Benfica 2.

By February, 1957, two tests had been completed on the Luanda structure, five miles east of Luanda, the capital. Fractured lower Cretaceous limestone at 5000 feet yielded from 500 barrels to 3000 barrels per day on chokes varying from 11 to 25 millimeters in the discovery well, Luanda 2.

The crude is 27 gravity, testing only 0.3 percent sulfur by weight. There is an estimated maximum of 150 feet of oil column. Two rigs are drilling in the area to determine the reserves of the field.

Lobito drilled 46,857 feet of hole in Angola in 1956, compared with a total of 29,604 feet in 1955. Two new rigs were added in 1956, bringing the total to four. Two are heavy rigs, one medium, and the fourth is a core drill rig.

The productive limestone is known

as the Cabo Ledo formation. All 1956 production was from Benfica.

Four oil wells and nine dry holes were completed during 1956. Of these, two oil wells and six dry holes were wildcats; two oil wells and three dry holes were classed as development wells. Seven core tests were drilled, including three on the Zango structure 24 miles southeast of Luanda.

The Petrofina group has governmental authority to build a refinery along the coast of Angola. Studies of a proposed 20,000-barrel-per-day refinery were continuing. About 30,000 barrels of Angola crude was shipped to Portugal in September, 1956.

Madagascar. Exploration continued in the Morondava Basin of southwestern Madagascar in 1956 with no encouraging results. Societe des Petroles de Madagascar (SPM), whose 65,500-square-mile permit covers the entire basin, employed four surface geological parties, three seismic crews, one gravity party and two drilling rigs during 1956. During the year, 31,000 feet of hole was drilled. Four tests were completed, two were still drilling at the end of the year, and another location had been staked.

Two gravity crews were to be added in 1957. A Tertiary-Cretaceous basin occurs along the southwest coast, and there are some possibilities for Jurassic production.

South Africa. The American Association of Petroleum Geologists Bulletin reported three wells completed in northern Natal during 1956 to Archean granites, with no shows encountered. Drilling in this, the Dannhauser area, continued.

South African Coal Oil and Gas Corporation, Ltd., (SASOL) was trying to increase production of its plant in the Orange Free State, 50 miles south of Johannesburg to produce gasoline and other petroleum products from coal. The plant operated at about one-tenth its designed capacity in 1956, due partly to technical difficulties. South Africa's oil consumption is increasing rapidly.

Standard Vacuum Refining Company of South Africa Pty. plans to expand its Durban, South Africa, refinery in a $9 million construction project slated for 1959 completion. Throughput of Persian Gulf crude was being increased from 20,000 barrels to 25,000 barrels daily. Foster Wheeler Corporation of New York City, prime contractors for the original refinery that went on stream in January, 1954, was scheduled to erect two new units, a powerformer and a hydrofiner, among other facilities.

Durban and other South African ports experienced a heavy increase in bunkering demands during the past winter when many ships were diverted from Suez around the Cape of Good Hope.

French Cameroons. Societe de Recherches et D'Exploitation des Petroles du Cameroun (SEREP-CA) has found gas distillate and is trying to establish oil reserves on a 3500 square-mile concession along a coastal area of the French Cameroons. The concession dates from 1952. First definite indication of commercial production occurred in 1955 when LA 101 well, located three miles east of Douala, blew out at 5787 feet after finding several oil and gas shows below 5231 feet.

SEREP-CA drilled 51,053 feet of hole in 1956, while completing five wells. Two rigs were drilling at the end of the year, continuing into 1957.

LA 103 was drilled to 9070 feet, where progress was stopped by high pressure gas which exerted a formation pressure of 6800 psi at that depth, frustrating efforts to drill through to basement. It was estimated that wells LA 101, 102, and 103 have proven a gas reserve of 16 billion cubic feet in a number of localized reservoirs. LA 104, located west of 101 was drilling below 3700 feet at the end of the year.

At Souellaba, a smaller gas reserve somewhat similar to the field proven at Logbaba described above, is being developed. The prospect is located on a peninsula on Malimba Bay, 25 miles southwest of Logbaba. In late 1956, SA 2 was completed at a depth of 8812 feet to 8845 feet, yielding gas from the Cretaceous at the rate of about 500 Mcf daily. The gas was reported to be rich in distillate. SA-3 and SA-4 were also completed during 1956, with negative results. It was hoped that an oil sand found in SA 2 between 8230 feet and 8340 feet could be developed commercially, but these two wells showed that the sand was of very small areal extent.

Surface geology, and intensive seismograph and gravimetric work were being carried out, in addition to continued exploratory drilling. Seismic data tied into subsurface data from wells drilled thus far indicated a sedimentary section about 12,000 feet thick, but facies changes are extremely rapid.

Senegal. Societe Africaine des Petroles (SAP), a French Government company, has been active in Senegal since early in 1956. During the year, 12 wells were drilled, with two more being drilled at the end of the year. The company has a 4200-square-mile concession, roughly triangular in shape, two sides of which are the shores of the Atlantic Ocean which come to a point at the tip of the Dakar peninsula. The concession dates from August, 1955.

A total of 44,153 feet of hole was drilled during 1956 by SAP. One well on the Dakar structure yielded a good gas show. The third Dakar test was drilling at the end of the year and a fourth had been staked. Shows of oil and gas have been found at Dougar, about 25 miles east of Dakar. Gravity coverage for the entire concession was completed in 1956. In addition, two reflection seismograph crews were at work.

Most of the hole made so far has been by core drill teams in an attempt to delineate the many indicated Cretaceous structures for later deep drilling with conventional rigs. Some offshore seismic work was being conducted to extend profiles as appropriate.

East of SAP's concession, a 15,800-square-mile concession was granted May 4, 1956, to Societe des Petroles du Senegal (SPS), owned on a 50-50 basis by The British Petroleum Company interests and French government and private French capital. The area is bounded on the southwest by a point on the coast 30 miles south of Baye, by Louga on the northwest, by Linguere inland on the northeast, and by the vicinity of Maleme on the southeast.

Two gravity crews and one reflection seismic party were scheduled to start working in January, 1957, with a tentative deep test being planned for spudding during the latter part

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of this year. A number of interesting structures were indicated.

Gambia. In Gambia, a British possession immediately south of Dakar, a seismic survey of the Gambia River has been completed by British Petroleum. A 400-ton vessel was able to navigate 250 miles inland, and carried the survey a short distance offshore from Gambia and Senegal. This work has been tied in with SAP's and SPS's exploratory data.

A gravity survey was also underway in Gambia at the end of 1956.

Mozambique. Mozambique Gulf Oil Company drilled two wildcats during 1956 on seismic prospects in Mozambique. The first test, Balane 1, located a short distance inland from the coast near the Sabi River, was spudded April 21 and completed on July 26. It was abandoned at a depth of 10,225 feet. The rig was moved to the second location, Temane 1, near the mouth of the Sabi. Temane 1 was spudded August 25, drilled to 11,500 feet by the end of the year, and abandoned at that depth shortly after. The next location, to be drilled early in 1957, was about 40 miles north of Temane 1.

Several gas shows have been encountered in the wells Gulf has drilled. Strata penetrated include Tertiary, Cretaceous, and (probably) some Jurassic. Most of the area surveyed in Mozambique has been very complexly faulted. The section penetrated is a mixture of continental and marine beds, with rapid facies changes. Gulf has already dropped part of the western portion and much of the southern part of its concession.

Zanzibar. On Zanzibar, BP-Shell Petroleum Development Company of Zanzibar, Ltd., commenced drilling in May on a seismic prospect. By the end of the year, the rig had penetrated to 12,600 feet. The test was drilled to 14,281 feet by early 1957 and abandoned at that depth. A gravity survey of Pemba Island, located about 40 miles north of Zanzibar, reportedly was completed during the year.

Tanganyika. In Tanganyika, the same company was reported engaged in structure drilling operations with three light rigs; 16,500 feet of hole was drilled during the year.

Kenya. In Kenya, BP-Shell was reported to have completed four party months of gravity work and about 2280 feet of stratigraphic drilling.

Somalia. In Somalia, Sinclair Somal Corporation, subsidiary of Sinclair Oil Corporation and operator for a group including Amerada Oil Company, Continental Oil Company, and The Ohio Oil Company, drilled a deep test at Gira 1, located 27 miles west of Obbia on the Indian Ocean. The well was spudded late in June, 1956, and abandoned at 12,764 feet in February, 1957.

Early this year, a second test was being drilled 60 miles northeast of the first near the coast. Sinclair Somal has a 56-million acre concession. Surface geological and seismic work are being pursued. No shows were indicated at Gira but Sinclair was encouraged by the favorable geologic section, reportedly dating to Eocene, Cretaceous and Jurassic ages.

Mineraria-Somalia, a subsidiary of AGIP Mineraria, exploration arm of the Italian government oil monopoly Ente Nazionale Idrocarburi has conducted surface and seismic work on its 11,700-square-mile concession in northeastern Somalia. A deep test, Sagaleh 1, was drilled south of Bender Beila. It was spudded in late 1955 and abandoned in 1956 at a depth of 10,720 feet.

Two other deep tests, both unsuccessful, were reportedly drilled by Mineraria, one north of Illiq and the other in the Ras Hafun Cape vicinity.

Ethiopia. In Ethiopia, Sinclair Petroleum Company completed six shallow tests in the Ogaden area in the east-central part of the country, and ended its 11-year search which commenced when the concession, now forfeited, was granted in 1945.

British Somaliland. In British Somaliland, Conorada Petroleum Corporation, The British Petroleum Company, and Standard Vacuum Oil Company continued seismic work on their concessions which aggregated 36,000, 11,000, and 6000 square miles, respectively.

Stanvac planned to start drilling its first wildcat in British Somaliland in January, 1958. Gravity and magnetic surveys already have been completed, and one Stanvac seismic crew was in the field.

Belgian Congo. There is some interest in the oil possibilities of the Belgian Congo. Societe Sobiasco is mining asphalt from impregnated sand at Mavuma. At Dekese, in north Kasai province, a stratigraphic test was drilled by Syndicat pour l'Etude Geologique et Miniere de la Cuvette Congolaise during 1956, with Petrofina working as contractor. The test was cored to 5500 feet, drilled to 6090 feet at the year's end, and abandoned at 6690 feet in 1957.

Societe des Petroles au Congo, a Petrofina affiliate, reported that quantities of products transported through its pipe line system in the Belgian Congo increased by 13.5 percent in 1956 over the previous year.

Gold Coast. In Ghana (Gold Coast), Gulf Oil Corporation has two 99-year leases, each of 100 square miles, one onshore and the other offshore. The area is in a Tertiary-Cretaceous basin with oil and gas seeps evident and with some thin oil-saturated sands outcropping and being known also in water wells.

Geophysical Service Inc. conducted offshore seismic work in March, 1956. Following surface exploration on land, Santa Fe Drilling Company of Whittier, Calif., moved a rig into Ghana and spudded Gulf's first test on June 29, 1956, at Kobnaswaso.

The test, located eight miles east of Half Assini was drilled to 10,670 feet and abandoned on November 30. The rig was moved to the second location, near Epunsa on the coast, and spudded close to the year's end. This test later was reported to be a dry hole.

British Cameroons. In the British Cameroons, an exploration lincense was granted during 1956 and geological field work was begun by British Petroleum interests in November.

Spanish Morocco. Minor oil exploration was being carried out by Empresa Nacional Adaro. Some diapiric structures have been mapped by surface geologists. A well was spudded in January, 1956, drilled to 685 feet and abandoned in lower Oligocene marls in September after much mechanical difficulty at Dchar Yedid.

A second well was expected to be drilled there in 1957, and a test of the Jemis del Sahel structure also has been proposed.

Outlook For Oil Industry Excellent

Continent is experiencing a dramatic upturn in energy consumption as four-fold increase in petroleum demand from 1955 to 1975 expected. To meet requirements, efforts to discover additional sources of indigenous oil production are intensified.

By F. McINTYRE

WESTERN EUROPE is experiencing a dramatic upsurge in energy consumption. Prior to World War II (1929-1937), inland energy consumption in what are now known as the organization for European Economic Cooperation countries rose only 0.4 percent per year. Since 1948, energy consumption has grown 5.4 percent per year. This postwar growth rate has not been simply a rehabilitation phenomenom. Energy consumption increased 5.6 percent annually between 1948-1952 and 5.2 percent during 1952-56. These growth rates and the level of consumption are shown in Figure 1.

Future prospects for energy growth in this area also are encouraging. A definitive study entitled "Europe's Growing Needs of Energy" was prepared by the OEEC Energy Commission under the chairmanship of Sir Harold Hartley, and was published in 1956 by the organization. This study projects the increase in energy consumption from 1955 to 1975 at an

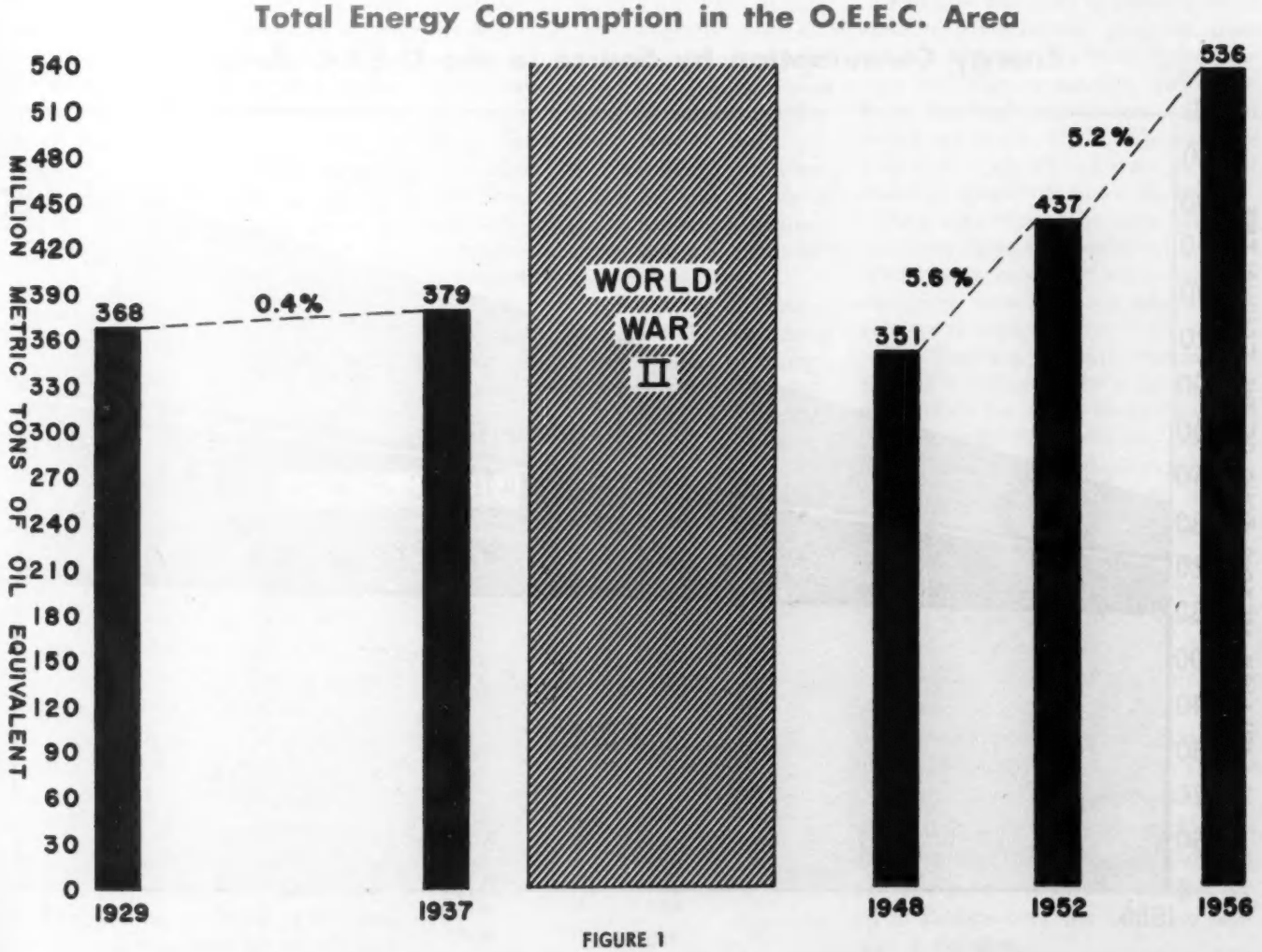


FIGURE 1

annual rate of 2.5 percent. In our judgment, this is a conservative projection. Basing our analysis upon the trend of national income, it is concluded that the energy growth in Western Europe may reach 3.2 percent over these two decades.

This forecast of energy consumption was reached in two steps.

1. Growth of national income was projected by taking into consideration the growth rates of employed labor force and productivity in the agricultural, industrial and services sectors of the economy.

2. Relationship between national income and energy consumption was studied to learn the percentage increase in energy consumption which is associated with any given percentage increase in national income. This relationship for a given country seems fairly stable over time, even though it differs from country to country.

Underlying reason for a higher rate of energy consumption in 1955-1975, as compared with the inter-war period, is the higher projected rate of national income. The peoples of Western Europe are achieving economic progress in the U. S. manner, and are becoming "high spending" economies.

The share of total national income going into investment is about 40 percent higher now than it was before the war. Intra-European trade is less restricted now than it was before World War II. Finally, projects under way to bring about an economic integration of Western Europe—such as the Common Market and the Free Trade Area—likely will create larger markets, adoption of mass production methods, economies of scale and, consequently, a higher rate of economic activity.

TABLE 1
Total Energy Consumption in the OEEC Area

	Million Tons of Oil Equivalent	Annual Growth Rate (In Percent)
1929	367.5	
1937	379.3	0.4
1948	351.1	
1952	437.2	5.6
1956	536.3	5.2

Non-Petroleum Fuels. In the midst of their competition, oil salesmen may lose sight of the fact that they are competing in a very real sense with the sellers of coal, hydroelectricity, natural gas, and, soon, nuclear power. The outlook for oil cannot be assessed unless the probable growth in the supply of energy from these alternate sources is taken into account.

Coal long has been the dominant fuel in Western Europe. In 1929 it supplied 92 percent and in 1937, 87 percent, of Europe's energy. Petroleum and hydroelectricity furnished modest but increasing shares during this period (See Chart II). However, in recent years the growth of coal production has lagged behind that of competing energy sources for a number of reasons, including these:

1. The best coal seams are exhausted and mining of narrower and tilted seams must be undertaken.

2. Quality of coal is deteriorating. More small coal is mined today, for

Energy Consumption by Source in the O.E.E.C. Area

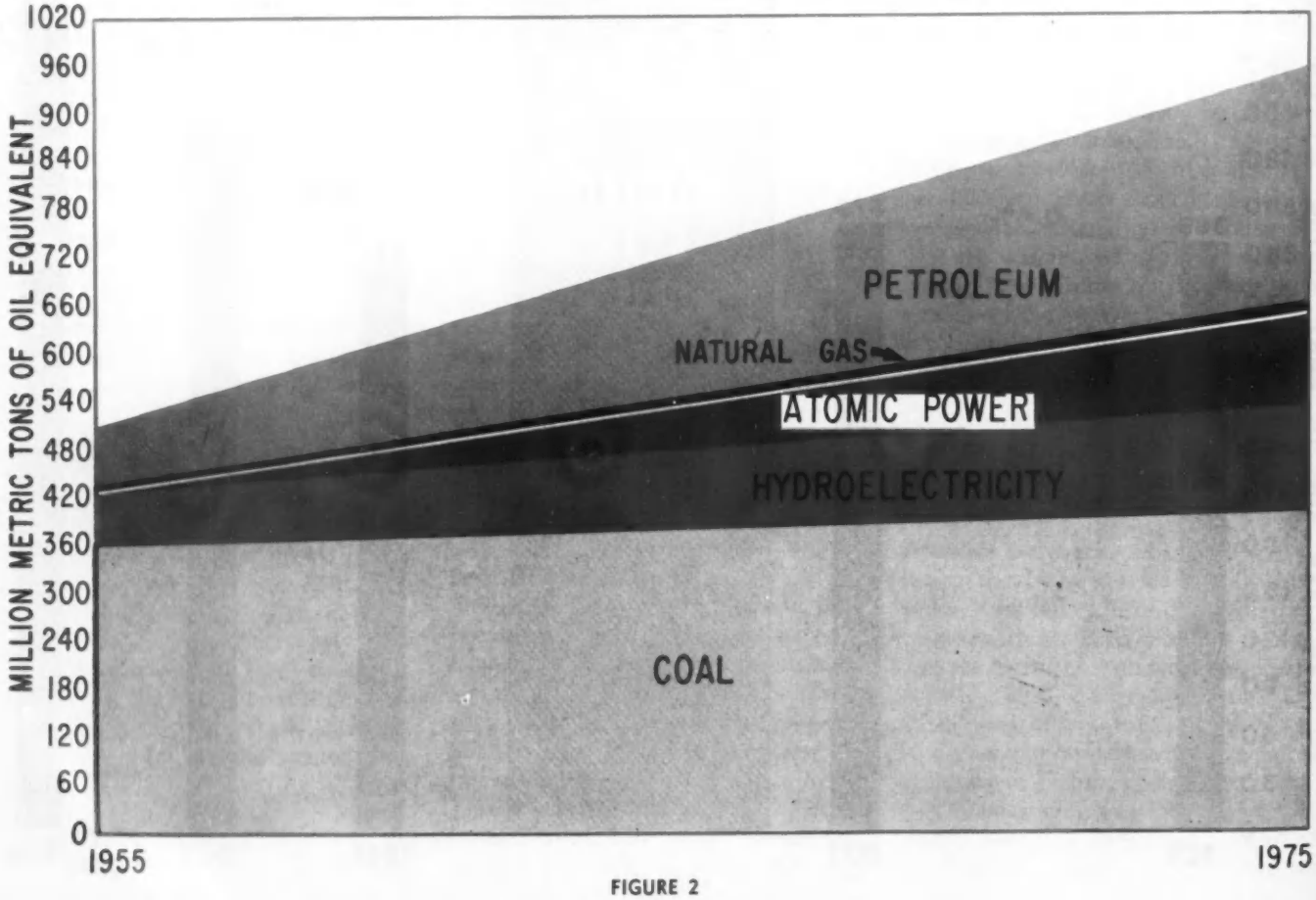


FIGURE 2

instance, in the United Kingdom than ever before.

3. Demand for such coal does not rise as rapidly as demand for total energy.

4. Most important, however, is the fact that with full employment above ground, recruitment of an adequate mining labor force is becoming increasingly difficult.

Considering these factors, it is our judgment that coal production in Western Europe in 1975 probably will not exceed 402 million tons of oil equivalent, and hence will supply by that time only 42 percent of total energy consumption. (A useful measure in which to express the relative contribution of each source to total energy consumption is "oil equivalent." An equivalent ton of oil is the amount of any fuel required to produce the amount of energy available from one metric ton of crude petroleum.)

Hydroelectricity, another important form of energy for Europe, has grown more spectacularly than has coal. The best natural water power sources have, however, been exploited, and the rate of future increase will almost certainly be reduced. In 1937, hydroelectricity supplied 6 percent of Europe's energy while the comparable figure for 1955 is 11 percent. In our estimation, this figure will not rise above 14 percent for 1975 or 131 million tons of oil equivalent.

Natural gas has played a relatively minor role in the European picture, and appears unlikely to assume a dominant position. By 1975, this source of energy is likely to supply less than 2 percent of total energy requirements, or 14 million tons of oil equivalent.

The most dramatic energy development between the present and 1975 appears certain to be the growth of nuclear energy. A wide variety of estimates, some of them extremely ambitious, has been presented. We have been obliged to develop our own judgment and would forecast 110 million tons of oil equivalent by 1975. According to this figure, atomic power will supply 11.5 percent of Europe's total energy requirements by 1975. Our figure is based on announced plans for the United Kingdom, and on our estimate of the continent's relationship to the United Kingdom with regard to atomic development.

TABLE 2
Total Energy Consumption and Energy Consumption by Source in the OEEC Area

	1929		1937	
	Million Tons of Oil Equivalent	Percentage	Million Tons of Oil Equivalent	Percentage
Coal	333	92	328	87
Hydroelectricity	14	4	23	6
Petroleum	14	4	26	7
Total	361	100	377	100

Petroleum Requirements. While there would seem to be a slowing down in the growth rate of petroleum consumption in the future—as contrasted to the high postwar rate of 12.9 percent per year—a 6.8 percent annual growth rate is forecast for the next two decades.

This means an almost fourfold increase in petroleum consumption—from 81 million tons of oil equivalent in 1955 to about 303 million tons of oil equivalent in 1975. This petroleum demand implies a steadily rising share for oil in the total energy picture, reaching 31 percent by 1975 as contrasted with its present 16 percent.

To meet this petroleum requirement, much effort has been expended to locate sources of oil within Europe. Since World War II, three considerations have combined to intensify the hunt for indigenous oil: A shortage of foreign exchange, national security objectives, and a mercantilistic hostility toward imports.

While it is true that in the immediate postwar period Europe as a whole was extremely short of foreign exchange, especially U. S. dollars, this situation has been significantly ameliorated by most countries of Western Europe.

Further, the companies supplying most of Europe's oil have arranged to eliminate most of the foreign exchange burden associated with such imports. While some forms of energy imports still may require that all or almost all of their cost be met in currency other than that of the importing country, this is not true of petroleum. Further, the enduring solution of Europe's payment difficulties will be found as rapidly as its export industries can achieve competitive effectiveness.

TABLE 3
Energy Consumption by Sources in the OEEC Area
(Million Tons of Oil Equivalent)

SOURCE	1955	1975	Annual Growth Rate, 1955-1975 (In Percent)
Coal	364.8	402.2	0.5
Hydroelectricity	58.2	130.5	4.1
Natural Gas	4.7	14.0	5.6
Atomic Power	....	109.9	....
Petroleum	81.1	302.9	6.8
Total	508.8	959.5	3.2

Because of the important part played by energy in a modern industrial society, any government is understandably anxious to secure its energy sources against interruption in times of crisis. This concern has its origin in national defense.

Efforts to meet this situation have included intensified drilling and exploration, plans for increased storage, and the development of alternative transportation routes.

Disruption of normal oil movements by the blockage of Suez served to reinforce these efforts even though, well before the opening of the Suez Canal and without full use of the Iraq Petroleum Company pipe line, the petroleum industry was meeting European requirements.

Perhaps Europe's greatest risk of delaying its economic progress arises not out of a concern about either foreign exchange or security, but rather from the wide-spread conviction, of which we in the U. S. also are often guilty, that anything produced at home is cheaper than an import.

Any nation prospers most when it produces those commodities in which it enjoys an economic advantage, exchanging these goods in world markets for needed imports.

To illustrate, Japan sometimes is said to be burdened by a dependence on imports for much of its food and raw materials. However, the Japanese have found that the export of a two-pound camera will secure the import of seven tons of petroleum. It is to be doubted that an equivalent quantity of indigenous energy could be produced without a greater investment of manpower and resources.

It will be important for Europe to test each proposal for the development of indigenous energy against the alternative cost of securing its energy from the most economical source. If the severe tests of the market place are permitted to determine Europe's acquisition of energy, the outlook for oil in Europe over the next two decades is excellent.

Continental Oil Industry Re-Awakening to Needs

Evaluation of operations shows pace is accelerating as governments encourage search for new crude reserves.

By R. E. KING

SINCE WORLD WAR II, three factors have stimulated the search for oil in Europe:

- Lack of foreign exchange.
- Conviction (often erroneous) that it is cheaper to produce something at home.
- A general security objective which was extant as a matter of national defense but was irritated by the Suez development.

The Suez crisis forcibly directed attention to the need for indigenous supplies in Western European nations, and resulted in government encouragement in intensified efforts being made to find new oil reserves. However, it is doubtful if new discoveries in Western Europe can approach the present level of demand, let alone suffice for the greater needs of the future.

West Germany. Following the war, intensive geophysical investigation was undertaken in West Germany. Earlier, emphasis had been on drilling around the numerous salt domes of Northwest Germany. It was realized that the spotty, uncertain salt dome reservoirs no longer were the main objectives, and attention was turned to a search for deep-seated salt structures in the salt dome basins and, later, to fault blocks aind stratigraphic traps.

In earlier phases of exploration, target zones were Lower Cretaceous sands. A series of troughs in Northwest Germany, was found with a thick section of Jurassic organic shales interbedded with porous sands, unconformable below the Cretaceous. The search for structural and stratigraphic traps in these Jurassic troughs proved highly rewarding, and many important fields were discovered.

A 75-mile wide belt barren of production between the Weser and Ems Rivers, lying between the oil fields of Hanover on the east and Emsland on the west, was opened to production and a chain of oil fields developed across this gap. New oil fields were found in the north near the Baltic Sea coast in Schleswig-Holstein. Attention was turned to the Rhine valley and southern Bavaria, and gas fields with some oil reservoirs were found in these essentially new producing provinces. Deep drilling in northwest Germany resulted in finding dry gas in dolomite interbedded in the Permian salt series.

In 1956 the first discovery of oil in a new Jurassic trough was made in Germany at Elsfleth, northwest of Bremen. The Kiel field, found in 1955 on the Baltic Sea coast, was extended greatly and an offshore well was completed. The northernmost oil field in Germany was brought in at Leiferde, north of Kiel near the Baltic coast. Also, domestic natural gas production increased 50 percent.

Part of the impetus to exploration in Germany was given by a protective tariff on oil imports. The dynamic German oil industry was staffed by German technicians, supported in part by the participation of Socony Oil and Shell Oil Companies. A prosperous oil equipment industry grew up. In recent years, German companies have looked abroad for new ventures, and have taken part in exploration in Peru, Spain, Greece, Turkey, Yemen, and Syria.

The Netherlands. In The Netherlands, Schoonebeek oil field, discovered during the war just west of the German border, developed into major proportions. Other discoveries by Nederlandse Aardolie Maatschappij 50 percent Royal Dutch-Shell; 50 Standard Oil Company (New Jersey), sole operator in the country, either have been gas fields in the Permian of the Central Netherlands or small oil fields producing from Cretaceous sands in the vicinity of The Hague, Rotterdam and Amsterdam. Last year when production from Schoonebeek field declined slightly to 18,250 barrels daily, the output from the two new fields discovered near The Hague and Rotterdam and that from the various small fields in Western Netherlands showed a marked increase to 2650 barrels daily.

Several additional fields have been found since the war in the English Midlands, but all these are of small size and have served only to maintain British production between 1000 and 1400 barrels per day. BP Exploration Company has continued its search for new fields and new producing basins, but its small measure of success appeared to indicate that the United Kingdom had little hope of any sizable indigenous production.

In France the government realized after the war that it was vital to the nation's future security to develop oil production in France and its African territories. A government agency, the Bureau de Recherches de Petrole, was set up to encourage oil exploration. Because of the lack of private risk capital in France a portion of the governments gasoline tax was set aside for the use of BRP to subsidize oil exploration by the payment of a share of exploration expenses and as a bounty on each ton of oil produced.

A number of new companies were formed, with varying percentages of government ownership, and these firms along with the older Compagnie Francaise des Petroles have conducted active geological, geophysical and drilling programs throughout France and the French Union.

In 1956 exploration expenditures of all companies in metropolitan France were $38.4 million and in 1957 the figure was expected to reach $53.5 million. In addition, the government-supported program of exploration in the Sahara cost $42.2 million in 1956 and will reach $52 million in 1957.

In France, no important oil discoveries were made last year. However, the 11,000-12,000-foot natural gas zone of Lacq field was extended, and at year's end its gas reserves were esti-

mated at more than 5 trillion cubic feet. Field plants were completed to extract natural gas liquids and sulfur from Lacq gas. Too, an extensive pipe line network was constructed to transport the gas to industrial centers in southwestern France.

Last May, natural gas production began at the rate of 35 Mmcf daily, and it was expected to rise to 140 Mmcf at the end of 1958.

Foreign capital was attracted to France after the initial success at Saint Marcet north of the Pyrenees in the Aquitaine basin, and discovery of Lacq oil field farther west in 1949. Esso formed a company, with minority participation by Gulf Oil Corporation and Atlantic Refining Company, and received an exploration permit in the Bordeaux area of the Aquitaine basin.

The second well drilled by this company, which is now known as Esso REP, resulted in the discovery in 1954 of the Parentis oil field, which now is producing about 24,000 barrels of oil a day.

In 1952 a Caltex affiliate made its initial move toward obtaining exploration rights in the Paris basin, and it was followed by Socony, Shell, The British Petroleum Company and D. D. Feldman's worldwide Petroleum Corporation, all of which companies by now have obtained exploration rights in various parts of France in association with French partners.

The French exploration boom was slow in getting off the ground, but after the discovery of the Parentis field there was a scramble for exploration permits in all the potentially productive basins of France. Now, only a few small areas remain uncovered by exploration permits or permit applications.

Italy. In Italy a wartime discovery of gas at Caviaga led to a great series of discoveries of gas fields in the Po valley. Foreign interests were denied concession applications, and the entire Po valley was assigned to exclusive control of a government company, AGIP Mineraria, for exploration and production.

Later a super-company Ente Nazionale Idrocarburi (ENI) assumed control of AGIP Mineraria as well as pipe line, refining and marketing companies in a large government-owned combine under the direction of Enrico Mattei.

The Po valley was an ideal place for seismic exploration, with generally easy shot-hole drilling and excellent record quality, and large structures to be mapped. Thirty-four fields were discovered through 1956, and natural gas production in the year 1956 reached 157 billion cubic feet. The gas is distributed by pipe line to all the chief cities and industrial areas of northern Italy, and it has given great impetus to the industrial development of the region. By saving the importation of large quantities of coal formerly brought in from the German Ruhr valley by rail routes through the Alps, gas production also has bolstered Italian economy through the saving on foreign exchange.

However, except for a small amount of oil from Miocene sands in the Cortemaggiore gas field, natural gas liquids, and the recent discovery of oil in the Busseto field east of Cortemaggiore, the Po valley has been nearly lacking in the liquid fuels so greatly needed in Italy. Some oil fields have been found along the Adriatic coast in peninsular Italy, but to date these have proved comparatively unimportant.

A new oil law was passed late in 1956 to replace the obsolete earlier legislation. However, the new law was considered highly unfavorable by companies from abroad, and Gulf Oil Corporation and others from abroad which had exploration permits or which had applied for exploration rights in peninsular Italy withdrew from the country.

Sicily. Under Sicily's oil law, favorable to foreign capital investment, Gulf Oil obtained several exploration permits and, in late 1953, discovered a major oil field at Ragusa in southeastern Sicily. After waiting a year for a development concession to be granted, Gulf put the field on production and development drilling was still under way. At the end of 1956, the 14 wells of the Ragusa field were producing 16,000 barrels per day of 19.5 gravity oil. In February, a 43-mile, 14-inch pipe line was completed to the refinery at Augusta.

AGIP Mineraria made what apparently was an important discovery at Gela, west of Ragusa field. The discovery well went on production the middle of April, and reportedly was pumping 7-gravity crude at the rate of from 1200 to 1500 barrels a day. Three other wells were drilling on the structure at distances of 1500 to 2300 feet from Gela 1, the discovery well.

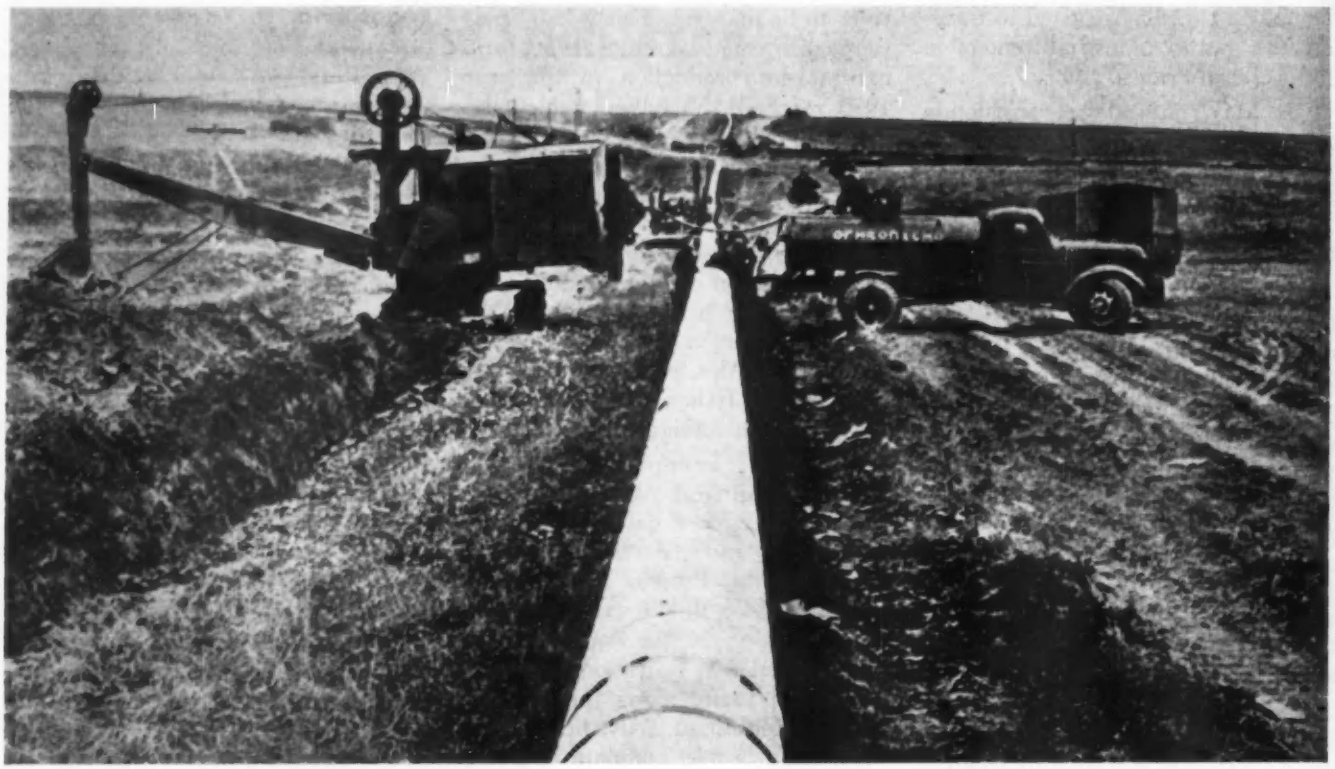
Yugoslavia. In Yugoslavia small oil production was found before World War II and two significant discoveries were made during the war. In the early post-war years there was slight change in the rate of production because of the general hard conditions in a country severely damaged by the war.

Since 1949 there has been a steady increase in production due to an intensive effort by the various state-controlled enterprises in each of the Socialist republics into which the country is divided.

Though hampered by severe shortages of materials and trained manpower several new fields were discovered, particularly in the Savar River valley southeast of Zagreb, in Croatia. While total production of less than 6000 barrels per day fills only 33 percent of the nation's needs, the steady increase in production from year to year has been notable. A sizable further increase was expected in 1957 due to the placing on production of two oil fields discovered in 1953, but shut in awaiting field development and the construction of pipe lines.

Austria. Withdrawal of Soviet control over Eastern Austria in August, 1955, resulted in the return to the West European economy of its largest producing area. Production in the rich Vienna basin, most of which is from Matzen field, was 70,000 barrels per day in 1955, but it declined to about 65,600 barrels daily in 1956 to bring production in line with the maximum efficient rate, which had been exceeded during the Russian administration. An oil discovery was made in Western Austria, east of Salzburg, in 1956, and exploratory drilling is active in the Vienna basin. Steps were being taken to utilize more fully the large reserves of natural gas in the latter area.

Other Areas. Postwar exploration has been active but unsuccessful in Denmark, Portugal, Spain, and Greece. Concession activity and some geophysical exploration or stratigraphic testing has occurred in Sweden, Belgium, Switzerland, and Malta.



This is a recent photo of a Russian pipe line spread at work in an undisclosed area of the USSR.

Decentralization May Affect Russian Oil

Abolishing of Oil Industry Ministry, which guided nation to oil production of about 1.3 million barrels daily during first five Five-Year plans and which initially scheduled a 2.2 million barrel daily producing level for 1960, expected to result in creation of complex difficulties.

RUSSIAN OIL MEN are caught in an industrial paradox unequalled in the industry's history. They operate under perhaps what are the best theoretical working conditions, yet they are infinitely worse off than their international colleagues.

Russians are blessed with sufficient funds, no concession or leasing difficulties, a vast area and complex operation which makes losses in one field negligible as compared to overall activity, no labor problems, and no price-marketing-competition problems.

On the other hand, they are cursed with the continuing pressures of the state and Communist Party for fulfillment of government goals at any price, even under constant fear of bodily harm; a never-ending series of bottlenecks and other obstacles which are inherent features of a state-operated economy; and often must operate in a manner recognized by Russian experts as incompatible with orderly commercial development.

The recent Khrushchev statement about the decentralization of Russian economy likely will leave a lasting imprint on the domestic oil industry. The Ministry for the Oil Industry will be abolished. The Union-wide Ministry of Geological matters will remain as a central agency, functioning in behalf of all ministries alike.

Centralization of the Soviet oil industry saw the rise to a production level of 477,400,000 barrels per year, or about 1,307,950 barrels daily, during the first five Five-Year plans. The sixth Five-Year Plan (1956-1960) initially was scheduled to reach a 1960 crude production level of 920,-700,000 barrels, or approximately 2,515,575 barrels daily.

Doubts that this goal could be reached without a central guidance

agency already have been expressed outside the Iron Curtain. Also, the financial ratio of the various oil trusts, or organizations, as to production and cost, investment and profits doubtlessly will create numerous local-level difficulties.

Production. Crude output for 1956 amounted to 571,208,418 barrels, or about 1,564,950 barrels, according to official government releases and the Soviet Statistical Bureau. This reflects a rise of 18,788,418 barrels, or 51,475 barrels a day, from the target set up at the beginning of 1956.

If correct, 1956 production was tantamount to an 11 percent increase from the 1955 level. In 1955, Dr. J. Brian Eby, WORLD OIL representative and consulting geologist, Houston, Texas, reported production of oil in 1955 amounted to 514,432,800 barrels, or 1.4 million barrels a day. He obtained this figure during a visit to Russia (WORLD OIL, Aug. 15, 1956, Page 174).

Each year since 1945 has seen crude output of the Soviet Union exceed that of the previous year (See Table 1).

TABLE 1
USSR Petroleum Production

YEAR	Annual Production	Daily Average	Percent Increase
1940.....	226,125,000	617,827	....
1950.....	275,221,000	754,030	21.7
1954.....	430,735,000	1,180,096	56.5
1955.....	514,381,000	1,409,263	19.4
1956.....	571,208,500	1,564,954	11.0

Second Baku. The Second Baku area, which had participated with 58 percent of the 1955 total crude output of the USSR, increased its share of total production to 62.1 percent. This comparison was based on 1955 oil output of 298,371,024 barrels, or 817,454 barrels per day, as compared with the 1956 yield of 354,720,428 barrels, tantamount to 969,181 barrels per day.

Reportedly, a significant increase also was achieved by Eastern Baku—an area comprising about 40 fields, of which 5 are located in Turkmenia, 20 in the Fergana Valley, and 1 in Ustmaja (East Siberia).

Oil production also was reported to be increasing in the Old Baku producing fields.

This development is following the directives expressed in the sixth Soviet Five-Year Plan (1956-1960) which initially demanded the 1960 oil production figure of 920,700,000 barrels, equivalent to a daily average of 2,515,574 barrels (See Table 2).

TABLE 2
Crude Production Increases Demanded By Sixth Soviet Five-Year Plan (1955-1960)

Producing Area	1955 Oil Production	Percentage Increase Demanded	Expected 1960 Oil Production
Ukrainia (Incl. former Polish fields).....	3,858,000	180	10,822,400
Uzbek.....	7,237,000	50	10,855,500
Kazakh (Incl. Emba fields)..	10,151,000	40	14,211,400
Kirgiz.....	843,000	680	6,575,400
Total....	22,089,000	92.2	42,464,700

In addition, the Old Baku area is expected to produce an average of 292,552 barrels per day by 1960, or 107,074,000 barrels for the year. Other significant increases demanded under the current Five-Year Plan include Bashkiria SSR, 82 percent, and Tataria SSR, 300 percent or 218,240,000 barrels. Part of the anticipated 91 percent overall production increase from 1956 to 1960 is expected to be furnished by Sakhalin Island, Perm and Tshaklov.

According to Russian reports, Old Baku's share of total Soviet crude production has declined from 75 percent to 22 percent, while the Soviet Federated Socialist Republic's share has risen from 13 percent to 70 percent. The SFSR producing areas include the Ural, Volga, Kama, and Pechora oil fields.

Two new trusts (companies) were established in 1956: The combined Stalingrad-neft and Saratov-neft in SFSR and Aksako-neft in Bashkiria SSR.

Complaints have been aired that lack of material made it impossible to begin producing the 500 recently drilled wells in Azerbaijan region. This same reason also has been given for the failure to restore to production 3500 old wells. Production costs in the Azerbaijan fields are the lowest among all Russian producing regions.

Offshore Production. The offshore oil fields of the Caspian Sea produced slightly less than 30 percent of the Caucasus' 1956 regional output. During 1954, production there had increased by 140 percent from 1950.

Since offshore operations began, 300 wells have been completed. Average daily production of these wells currently is between 675 barrels and 950 barrels, with some wells exceeding 1700 barrels.

Major offshore producing field is Naftjanja-Kaminy. Up to the beginning of 1955, about 545,600,000 barrels of oil had been produced from offshore deposits.

New Oil Fields. A series of new fields has been discovered during the past several years, and these new discoveries have led the government to hope for increased output by 1960 which will be almost double the 1955 yield. In addition to recent field discoveries reported by Dr. Eby after his visit to Russia in 1956 (WORLD OIL, Aug. 15, 1956, Page 177), are the following:

- **Tatar Republic.** Tshekmalgushev and Kaltasin—small fields—where development has been hindered through lack of funds.
- **Ukrainian SSR.** The former Polish areas of Dolina and Bitki have been the scenes of new field activities. New oil deposits also have been discovered at Kabodnjany, in the Stanislav region, at Bilcze-Wolica, near Stryi, and a new gas field was found at Schebelino, near Kharkov. Newly-discovered—but not yet developed—is the Swidniki oil field in the Lemberg area, where considerable drilling was scheduled to occur this year.
- **Caucasus (Azerbaijan).** Natural gas has been found in the Upper Oligocene around Staropol. Initial wells drilled at Kuma Valley, a new producing area, have been put into production.

Another new field was discovered in the Northern Caucasus—Budennovskoje, near Praskoveja village. Four wells had been completed there to 8200 feet.

Other new fields included Ipatovsk, Georgievsk, Kursavsk, Blagodarnensk, and Petrovsk in the Tshekessian region, as well as Troitzkoje, Anastasievskoje, Novo-Dimitrovskoje (oil and gas) in Krasnodar region.

In the Dagestan region, near Selli, and in the Grosznij area, near

Tshernje-Gory, commercial crude production also was being readied.

During 1956, the Pjestshannje Island (in the Caspian Sea, near Baku) oil field was extended considerably, and a new trust (company) was formed to produce the area. The Karadag deposits, discovered in 1956, stretch from the Caspian Sea shore in the direction of the Apsheron peninsula and Kobystan area.

• **Central Asia, Far East.** Oil has been discovered in the upper Jurassic formation in the Kzyl-Kum desert of Uzbekistan—the first discovery in that area where upper Jurassic structures predominate. The site is southeast of Buchara.

Five other oil and gas fields were discovered in Uzbekistan last year, including Severnij, where development work had begun. Other fields, with crude in the lower Cretaceous, are located near Khodziabad, from whence a pipe line has been laid to the Fergana Valley.

• **Siberia.** Little exploratory drilling was reported in Siberia, and only one producing area was discovered—a natural gas field at Berezova in the Western Basin which has been on production since 1956.

Natural Gas Production. Russia claimed production of 483.8 billion cubic feet of natural gas last year, or 32.1 percent more than during the previous year. The 1957 production plans called for an output of 741.6 billion cubic feet, or 30 percent greater than the 1956 yield.

The 1960 goal was put at 1412 billion cubic feet, and fulfillment of this goal was described as possible in view of the large new gas reserves reportedly discovered and improvement in conservation of natural gas.

Five natural gas fields were discovered in 1956 in Uzbek Republic, but development work had been initiated at only one field—Severnyy. Exploration crews were operating at three other sites near Uzbek, and were studying the Lower Cretaceous at Khoziabad region. Uzbek gas reserves were believed to be extensive, and the first eastern gas pipe line from Khoziabad to Fergana was scheduled to be completed this year.

Other new deposits were discovered in Northern Caucasus, Eastern Ukrainia (formerly Poland), the Volga area, and the Autonomous Komare Republic.

The 1951-1955 exploration resulted in the discovery of 99 new gas fields, of which the Berezov district in the Siberian Basin was described as the most important. Gas from there is to be transported by pipe line during 1957-1958 to the Ural industrial centers.

A total of 1485 miles of large diameter gas pipe lines were to be constructed in 1957 to furnish gas to the cities of Dnjepropetrovsk, Dnjrprodshershinks, Belgorod, Taganrog, Shdanov, Voroshilovgrad, Voronesh, and Novo-Cherkassk.

Russian pipe line construction companies reportedly had improved considerably their techniques and ability. The 500 mile, 19 inch pre-war pipe line from Kiev to Moscow required two years to build. However, the 800 mile, 28 inch line from Stavropol to Moscow was completed last December after eight months of work.

In response to the demand for increases in the use of natural gas for reinjection, it was announced that in Sakhalin 1059 MMcf of gas was reinjected into wells during the first eight months of 1956. This reportedly increased Sakhalin production by 136,000 barrels during the period.

The post-war gas discoveries of Stavropol (Baku) and Shebelino (Ukrainia) were turned over to purely industrial use. The third ranked gas producing area is Berezovo, in Western Siberia, where one of the gas producers along the Ob River produced almost 53 MMcf per day. Because of this expanding production, a petrochemical plant was scheduled to be constructed between 1956 and 1960.

Drilling. Drilling rates and footage drilled during 1956 recorded increases from the previous year's results, although no government targets were established for either operation.

About 2000 wells were completed, 10 percent below the planned objective, of which 200 were drilled in the Caucasus area. Footage drilled in Tatar Republic, which amounted to almost six million feet during the 1951-1955 period, was scheduled to reach the 17-million foot level during the 1956-1960 period. More than 80 percent of all wells completed were drilled with turbo drills, as compared with 79 percent in 1955, 65 percent in 1954, 41 percent in 1952, and 30 percent in 1951.

Russia is spending increasing

RUSSIAN CRUDE PRODUCTION MORE THAN DOUBLED SINCE 1950

	Barrels Daily
1940	617,800
1945	386,200
1950	754,000
1955	1,409,300
1956	1,560,678

amounts of money on drilling equipment experiments, with most of the funds earmarked toward further improving the operations of various sizes of the turbodrill. Additional testing includes experimentation with the drilling technique of using explosions to loosen the ground structure with the drilling mud removing the dirt. This testing was continuing in the Kuibyshev area, and, it is claimed, will exceed turbodrilling speed by 10 to 15 times.

Still another method of drilling undergoing experiments is the electrobore method, in which an electric motor, between the bit and drilling string, turns the bit. This is in the experimental stage only, the Russians advise.

Present turbodrills range from 10 inches to 9 inches, 8 inches and 6⅝ inches, with the latter being used for core drilling. A 5 inch drill will be marketed soon, and a 4 inch type was undergoing tests.

Russians have not found their jet bits successful, but they are reported to be successfully testing a new system to increase torque—by installing a flywheel system between turbine and drill bit to utilize inertia momentum.

Exploration. Crude reserves in the Soviet are only estimated, since Russia, and the entire Eastern Bloc, operates behind a cloak of secrecy which affects all information. However, some reliable Western oil circles believe that approximately 6.8 billion barrels of proved crude reserves exist in the USSR, with probable reserves extending to slightly more than 25 billion barrels.

Latest information available through WORLD OIL's private sources indicates that proved crude reserves amount to 6,022,060,000 barrels, with probable—unproved—reserves calculated at approximately 54,560,000,000 barrels. Thus, overall crude reserves would be in the neighborhood of 60.5 billion barrels, of which a total of 17,050,000,000 are believed to exist in the Caucasus, 18,414,000,000 barrels in the Volga-Ural area, and 8,184,000,000 barrels in Emba and Far East areas.

Exploration operations were scheduled to be speeded up in the Ukraine, Siberia, Central Asia, Kazakhstan, and the Far East. Central Asia and the Far East were to be emphasized not so much because of good prospects but rather because of the government's aim of developing local oil production wherever possible. If successful to the anticipated degree, the government, of course, expects to save the transportation costs of crude which, in Russia, exceeds by many times the value of oil products.

In the West Siberian Basin, where swamps make erection of deep drilling rigs impossible, wells up to 9850 feet were scheduled to be drilled. The Jurassic formation reaches to that depth.

Continuing exploration work was reported from the Caucasus area, where important deposits were believed to exist in the Karabulak area of Uzbek. Also, the Kzyl-Kum desert was the scene of accelerated exploration, and one well had been put on production there.

Brisk progress was reported at Bitkow and Nadvornanskij in Ukrainia, and other areas were to be explored near Poltava. Preparatory work was under way in Feodosija, Priozernij, Mysovij, and Belokamenka areas.

Pipe Lines. An extensive network of pipe lines was scheduled for development within the next few years. The most important were the products lines connecting Krasnovadosk and Ashabad, Baku and Batum, and Omsk and Tatarsk.

A long-range project being mapped is the pipe line from Omsk to Chabarovsk in Central Siberia, which would ease the heavy transportation burden which has been shouldered by the trans-Siberian railroad.

- A 60-mile section of the Ufa-to-Omsk crude line.

Consumption. Per capita domestic requirements for the Soviet Union was given officially at 2.2 barrels for the year 1955, together with a report that an increase to 4 barrels was planned for 1960. Official United Nations estimates put the USSR census at approximately 210 million people.

Thus, 1955 requirements would have amounted to 462 million barrels, or about 1,265,750 barrels per day. The 1960 requirements, disregarding the growth in population, were expected to amount to 838,860,000 barrels, or a daily average of 2,291,950 barrels.

Since 1955 production was reported last year by Dr. Eby at a level of 514,432,800 barrels, or 1.4 million barrels daily, it was indicated that a surplus of more than 52 million barrels, or about 135,000 barrels daily, existed.

However, since the government's 1960 production quota calls for crude output of 920.7 million barrels, or about approximately 2,515,500 barrels per day average, a surplus of 40.7 million, or about 111,200 barrels daily, would exist. But the increasing population trend and the question as to whether the 1960 production goal can be fulfilled were factors which were expected to narrow considerably the margin of excess supply over demand.

Too, since Soviet production statistics are not accurate to Western standards, such calculations at best serve only as estimates.

While petroleum statistics are subject to political disfiguration for propaganda purposes, census figures and domestic requirement levels can be selected by the uncontrolled government at random.

For example, Soviet export figures for 1955 are believed to have amounted to approximately 41 million barrels. Considering that Austria had to deliver to the USSR during that year approximately 10.1 million barrels of crude (during the first half of 1955 under direct Soviet field management, and second half under Austrian compensatory deliveries) and that Rumania furnished some crude and oil products, Russian exports must have been more than the 16.9 million-barrel figure reached by study of the statistical data stemming from Russia.

Also, while the Free World reports per capita oil consumption on the basis of civilian consumption or requirements, the Soviet Union counts armed forces consumption (or requirements) along with civilian demands.

Some change has been planned in domestic consumption by increasing the production of motor vehicles by 46 percent during the Current Five-Year Plan (1956-1960), by a hoped-for 100 percent rise in tractor production, a 1100 percent boost in diesel rail locomotive output, the change from coal to fuel oil industry, and

the switch from wood, coal and peat utilization as solid fuel to natural gas.

Military Allotments. It may be idle speculation that the Russians reserve tremendous volumes of oil for their military establishment, most probably for storage farther east. But history substantiates this reasoning.

With oil centers relatively easy to reach from the west, the length of logistical lines has forced every intruder thus far to stop around the Moscow line—Napoleon in 1804 and Hitler in 1941.

A Russian offensive aimed at driving back such intruders would develop from the eastern regions—where oil production is absent or in its early stage of development. And this fact may account for the relative scarcity of oil products despite increasing production and the fact that the Soviet Union somehow "consumes" huge amounts of oil without having the relative number of civilian vehicles or industrial units to absorb these volumes.

Exports and Imports. Russia is self-sufficient in oil and petroleum products. Its export obligations deal primarily with the countries of the European and Far Eastern satellite bloc. They look upon Moscow as not only the political leader but also as the major supplier in times of need.

Russia does not need to export oil for the sake of income. Deliveries made within the Eastern Bloc, European and Asian satellites, are handled through the COM-ECON (Organization of Mutual Economic Assistance), and only trade with the Free World is listed under export.

Into these exports, however, are pooled domestic, Rumanian and Austrian reparation oil so that no one knows the origin of Soviet offered or delivered oil.

It has been indicated that the 1956 difference between domestic production and requirements amounted to an excess of supply over demand of approximately 17 million barrels. By comparison, Soviet 1955 exports amounted to 40,920,000 barrels and 1954 exports to 30,690,000 barrels. Prior to 1952, Russian exports were negligible.

So it appears that both Rumanian and Austrian oil is sold as Soviet product exports. Russia has a priority purchase right within the Rumanian petroleum industry to an unknown degree and for an unknown period of time. The price which the Soviets pay is too little to represent actual, orderly commercial intercourse.

Rumania, therefore, had sent a government delegation to Moscow to beg the Russians to increase their payments for Rumanian oil. From Austria, Russia receives (beginning in 1955) 6,788,000 barrels of oil free of charge for a period of ten years, and an additional 1,355,600 barrels of oil free for six years.

Both Rumanian and Austrian deliveries are believed to be the principal source, if not the only one, of Russian exports. Yet, both countries will be forced to import crude and refined products within a few years if their required exports to Russia are not reduced and if their respective domestic production does not increase.

The following Soviet export offers and/or deliveries recently were traced:

- **To Greece**—Almost 1 million barrels. Reportedly, this trade has resulted in Turkish anger at Greece since Turkey has been unable to import Soviet oil.
- **To West Germany**—The Hamburg firm of Wierskitzky reportedly has contracted for fuel oil and diesel fuel which it will transport in its own tankers loaded at Black Sea ports until September, 1957. The Teerchemie firm, also of Hamburg, was purchasing fuel oil under a 1957 contract.
- **To Denmark**—Apparently, high prices are the reason for the Danish refusal to buy Soviet products. Russia is reported to have offered about 270,000 barrels, delivered to Copenhagen in Soviet tankers, with another approximately 680,000 barrels of crude available if Danish shipping space were available on the Batum-to-Copenhagen run.
- **To Switzerland**—An unconfirmed Austrian news agency dispatch reported that early in December, 1956, Russia offered Switzerland about 677,000 barrels of crude oil from the Austrian deliveries to the USSR; however, the price was said to be too high for the Swiss.
- **To Italy**—Russia has sought to trade about 10¼ million barrels of crude oil and fuel oil amounting to a third as much in return for five tankers in the 18,000 dwt class and five in the 5000 dwt class.
- **To Israel**—Russia has furnished about 20 percent of Israel requirements. However, the Soviets reportedly refused to load a tanker at Odessa early in November, 1956. No further news had been received that Russian deliveries were resumed.
- **To France**—A trade agreement valid from the beginning of 1957 to the end of 1959 will provide for the French purchase of several hundred thousand barrels of Soviet oil products.
- **To England**—Recently, the first Soviet crude to reach England in 17 years reportedly was unloaded at Mersey harbor from the Russian tanker Grodno.
- **To Morocco**—About 340,000 barrels of crude will be shipped by the Soviets to Morocco during the current year, representing about five percent of the latter's domestic consumption.

During the first half of 1956, Soviet exports amounted to $24.8 million, according to Russian information. In addition to crude and refined products, Russia also shipped turbodrills to the U. S. and to West Germany and delivered two drilling rigs, worth $1.3 million, to India. A team of 110 Russian engineers was to train Indian nationals and was to supervise drilling operations scheduled to begin in Punjab, north of Delhi.

Yugoslavia's Oil Facing a Bright Future

THE FIRST economic assistance agreement between Marshal Tito's nation and the Kremlin since the 1948 ousting of Yugoslavia from the Cominform was signed Aug. 2, 1956, in Moscow. It provides for Soviet delivery of "materials needed for Yugoslav oil exploitation."

Before and after this pact, Yugoslavia has invited and used U. S. oil experts in its desperate search for more oil. Thus, Yugoslavia is receiving aid from the world's two leading powers.

And this two-sided assistance is bringing results. The nation has

achieved a spectacular rise within the world of oil, and the future looks optimistic as well-trained oil men are present to handle the most modern Western and Eastern oil field equipment. Too, financing of the oil business — through government budgets rather than company financing—appeared to be adequate last year. Returns from ever-increasing crude production and refining earned the state additional income.

Thus, Yugoslavia's oil industry is operating on a sound basis economically, and enjoys the advantage of having sufficient reserves and customers in both the West and the East. Although imports rose slightly in 1956, no further increases were expected.

Drilling. Naphthaplin, Yugoslavia's largest oil producing enterprise, recorded the footage figures shown in Table 1 for the years indicated.

TABLE 1

Footage Drilled in Yugoslavia, 1952-1956

Year	Footage
1952	101,998
1953	161,022
1954	148,041
1955	184,261
1956	245,074

The increase in footage drilled during 1956 over 1955 amounted to 33 percent, which was accompanied with a production increase of 16.6 percent. Of the 1956 footage drilled, 101,746 feet—17 wells—resulted from wildcat tests.

The regional division of drilling last year is shown in Table 2.

TABLE 2

1956 Drilling in Yugoslavia

AREA	No. of Wells	Footage	Average Depth per Well (Feet)
Sumecani	27	127,995	4740
Dugo Sselo	12	51,473	4289
Slavonia	3	16,633	5544
Pokuplje	3	15,147	5049
Prosavina	5	21,880	4376
Cabuna	1*	8,044	....
Vukovar	1*	3,517	....
Others	n.a.	17,018	n.a.
Total	52	245,074	....

* Drilling at year's end.

Thirty-three production wells, with total footage of 146,768 feet, either were completed or were drilling at year's end. Of these, 26 had been classified as oil producers.

Europe's deepest well is claimed by Yugoslavia—15,470 feet. The well is in Buljarica, near Petrovac, in the Montenegran (Adriatic) coast area.

Sixteen wells were completed in the Dugo Sselo field last year, and the first four went into production early this year.

Production. Yugoslavia's crude output last year amounted to slightly more than 2 million barrels, or about 5800 barrels per day. (See Table 3.)

TABLE 3

Yugoslavian Crude Production, 1954-1956
(In Barrels)

STATE	Year 1956	Daily 1956	Year 1955	Year 1954
Croatia	1,799,837	4,916	1,542,596	1,238,908
Slovenia	276,381	754	314,424	322,575
Serbia	44,222	120	.....	.....
Total	2,120,440	5,790	1,857,020	1,561,483

Major oil producing areas during 1956 were Gojle, with 42,446 barrels; Mramor Brdo, 294,554 barrels; Sumecani, 327,737 barrels; Bunjani, 124,422 barrels; and outside of Croatia and Ivancic-Klostar, 1,010,677 barrels. The remainder of the annual oil output came from smaller fields.

The domestic natural gas production reached 1.3 billion cubic feet last year, as compared with the 1.1 billion cubic feet produced in 1955 and the 914 Mmcf recorded in 1954.

The national gas output could be raised considerably if sufficient pipe line transportation facilities existed and if large scale consumers were found. Thus far, however, only two pipe lines transport gas from fields—one from Janja-Popovaca-Sisak and another from Popovaca to Zagreb, the capital.

Pipe Lines. Naphthaplin of Croatia reported that last year a total of seven miles of 2½- and 3-inch pipe lines were laid in its fields, in addition to a 2.3-mile, 6-inch line from Dugo Sselo field; a 6.7-mile, 6-inch gas field gathering system; a 1.7-mile line from Dugo Sselo; and a 5.8-mile pipe line from Lipa to Zagreb.

Exploration. Again, this year, a substantial portion—$533,300,000—of the investment for industry and mining will be devoted to exploration work in the oil industry. This will exceed the previous year's level by as much as 27 percent, indicating the expanding interest of the Yugoslav Federal government in the nation's oil business.

This continuing interest paid off during the early fall of 1956 near Vukovar, where at 3363 feet and at 3527 feet oil was found. Also successful was the study conducted near Becej, where it was expected oil would be found.

In Montenegro province, exploration operations were being conducted near Ulcinj, Petrovac and Buljarica, where a West German firm from Hanover was conducting seismic operations.

Also, the Drava River belt was being explored during 1957 by the Naphthaplin enterprise near Cabuni and near Mosti, which is northwest of Bilogore.

New Fields. The sixth Yugoslav postwar field opened was that of Dugo Sselo. Located 11 miles east of Zagreb, 12 wells have been drilled of which four were shut in as of January, 1957, and eight more were readied for shut in status.

Drilling work there began late in 1954 after the area had been mapped. The first four wells were expected to produce a total of 1445 barrels of oil daily from an average depth of 4593 feet. A two-mile oil pipe line had been built to the railroad station. Reserves of the field were believed to be sufficient for a 15-well daily output of 360 barrels for 20 to 25 years.

Another, more recent oil field is Jermenovci in southern Banat. The field produced 144,400 barrels of oil last year, or an average of almost 400 barrels daily. Production this year was expected to reach a total of 361,000 barrels, or an average of almost 1000 barrels per day.

The nearby Becej oil deposits are claimed by Yugoslav experts to exceed the Jermenovci deposits by far, but no actual evaluation of the Becej deposits had been made.

Economics. Yugoslavia's domestic production fulfills only about one-third of domestic requirements, the

remainder being made up by imports. However, the nation's geographically favorable position in the Mediterranean allows relatively favorable import rates from the Middle East and the Soviet/Rumanian ports.

The number of motor vehicles operated by state agencies amounts to about 45,000, of which about 12,000 are automobiles, 20,000 trucks, 1500 buses, and the rest tractors. Motorcycles number about 80,000. So, in view of this relatively small number of motor vehicles, domestic consumption of gasoline is left primarily to the armed forces.

East Germany Crude Oil Hopes Dwindling

CREDITED WITH being a leading pioneer and one of the world's most advanced producers in the field of synthetic fuels production, East Germany has given up its earlier projects designed to rapidly develop its oil industry. Emphasis will be put on synthetics in the future, since exploration operations during the past five years have not proven any commercially-produceable oil or sufficient natural gas to warrant industrial utilization.

Although operating within the Russian orbit, the East German oil industry does not enjoy direct Soviet assistance. Consequently, it shares the same fate as Czechoslovakia and Bulgaria. Crude oil from natural deposits, however, is a commodity East Germans need not press hard for because of the artificial fuels industry and a sufficient supply of soft coal. These two sources produce enough to satisfy the tightly-controlled requirements and to permit some exports into West Germany.

Drilling. Hopes of discovering crude oil near the West German border, where oil is found abundantly in the Hanover area, have not materialized despite extensive drilling. Most of the 27 wells drilled in this area from 1951 to the end of 1956 were drilled along the border but without success.

Drilling reportedly has been completed near Babekuhl, near Werl-Geestgottberg, at Bath Wilsnack, Barenthin, Rambow, and at Wukov. No oil was reported found.

Production. Production last year is estimated at a maximum of 271,500 barrels, or an average daily yield of approximately 740 barrels. During 1955, total production of 217,200 barrels resulted in daily average output of almost 600 barrels per day.

Reason for such small crude production, of course, lies in the fact that the only producing wells, some of which are 15 years old, are slowly being depleted. Too, only minor production has been recorded from post-World War II wells.

Waldekath still is the center of Eastern Germany's crude production, with daily yield of 400 barrels, followed by Ettersberg, Langensalza and Fallstein.

The overall plan for the 1956-1960 period demands that "by 1960 the basis for oil production on industrial level is to be assured." A newly-established peoples enterprise Oil-Earth Gas, comprised of the three separate oil and gas companies existing since 1950, is to work in close affiliation with the State Geological Commission of East Berlin in seeking the location of new oil deposits.

This new company, incorporating geophysicists, geologists, mineralogists, drilling engineers and drilling crews, has been given quotas on operations which were aimed at doubling the prescribed limits of work to make the 1960 goal a reality.

Exploration. Exploration operations being continued over a large area of the Eastern German state has indicated a possible anticline that reaches from Gifthorn to Babekuhl and Werl.

Two wells were drilled near Werl, with oil traces having been found. Shallow salt formations have been found near Barenthin, Geestgottberg and Rambov. These formations also have been located in the Southern Brandenburg province—at Blenkensee and Mittenwald. Currently, Southeast Brandenburg is under study.

Oil traces have been discovered in the dogger sandstone in Western Altmark province, and faint traces have been found in the Rhaet of Western Mecklenburg and in the Kamin structure. An anticline was recognized in Southern Brandenburg, along the villages of Golzow, Buchholz, Jaenchendorf, Staakov and Gross-Koeris.

General Economics. Annual requirements of crude oil are expected to reach 16.9 million barrels in 1957. Of this amount, synthetic fuel plants are expected to furnish about 12.9 million barrels, with the domestic crude supply and imports making up the deficit.

During the 1956 Leipzig Fair, East Germany surprised Western oil circles with its offer to export $25 million worth of crude oil to West Germany in an effort to reduce East Germany's trade deficits with its economically sound neighbor.

With East German crude production amounting to less than that volume, it was apparent that the offer would include East German imports.

Exports and Imports. A Mineral Oil Import and Export Company, Ltd., was formed last April in East Berlin, and was entrusted with the monopoly-like foreign oil trade. The synthetic fuel producers thus now have a centralized export agency.

Western observers also claim that this state monopoly is a front agency which is dominated by Soviet Russia and which serves the latter's interests more than East German interests.

Major trade partner for Eastern Germany's exports is West Germany. The Western Federal Republic had on order in 1957 $17 million worth of crude products as compared with $14.5 million worth imported during 1955. These imports included, by value, gasoline, $6.5 million; diesel fuel, $6.5 million; paraffin, $2 million; wax and other products, $2 million.

Czech Oil Industry Progressing Slowly

CZECHOSLOVAKIA'S firm allegiance to the reigning Kremlin politicians of changing times and changing political and economic trends has not been rewarded by the Soviets as far as assistance to the oil business is concerned. Whether the traditionally chauvinistic Czechs refuse the idea of

direct Soviet supervision in economic enterprises or whether the Soviets refuse to aid this country in what may appear to be a hopeless adventure, the fact remains that too few, if any, Soviet oil experts have been sent to help this westernmost Soviet satellite.

Oil, on the other hand, is of vital importance to the Czech primary energy balance, especially in view of a widening gap between coal production and requirements and the slow development of electrical power.

The 1956 Czech requirements for oil were estimated to have reached the 6,782,000-barrel level. Of that, less than 1.3 million barrels came from domestic oil supplies. About 2.7 million barrels were furnished by the North Bohemian synthetic oil plants and the remainder was covered by imports.

Drilling. Through lack of organization, little drilling progress is being achieved. Available drilling rigs are being used for development drilling even though new producing wells are shut in upon completion. Exploratory drilling is suffering.

Two Soviet drilling rigs were imported during the summer of 1956 to speed up work. Meanwhile, at least one engineer has complained that drilling speed, cost per foot and cost of barrel of crude produced is nowhere near the European average.

Although it was planned that during the Second Czech Five-Year Plan (1956-1960) turbodrilling would be conducted on a wide scale, only rotary rigs are in use.

Production. Czechoslovakia's 1956 crude production remained under the 1.4 million-barrel-per-year level (about 3700 barrels daily). Most of this crude came from the 150 wells being operated at Groedig. The 1956 output was between 70,000 barrels and 100,000 barrels above the previous year's yield.

In 1953, Czech government economic plans called for 1953 crude production of 1.6 million barrels, or about 4400 barrels daily. But production that year amounted to barely 746,000 barrels, or slightly more than 2000 barrels per day. It is of significance that more than three-fourths of the total 1956 oil output stemmed from prewar fields.

The Czechs have hopes, however, of increasing 1960 production by 40 percent over the 1956 output, or to slightly more than 5000 barrels a day.

Czechoslovakia's natural gas production is on the increase. Distribution facilities, rather than reserves, govern the expansion rate of the business. In 1945, gas reserves were estimated at slightly less than 7 billion cubic feet. Recent claims report that exploration activities have increased this reserve to "several hundred billion cubic feet."

A February, 1957, report said that only ten percent of the Slovak gas wells are actually in production, with the remainder being shutin pending demand growth and availability of transmission facilities. Gas now is being used only from deposits fields near Austria—to prevent Austria from producing alone from reserves that straddle the border.

Pipe Line. A 78-mile gas pipe line was planned for 1956 completion from Pardubice refinery to Olomuce, however, only 24 miles of line pipe had been laid by year's end.

Another gas pipe line was planned to transport Zohor-Breclav gas to Prague, the capital. This line was scheduled to be commisioned late in 1957.

The gas pipe line from Trnava to Dubnica, via Neustadt/Waag and Trencin, was nearing completion at mid-1957. Still another pipe line has been planned to link Brno, in Southern Bohemia, with the West Slovakian gas field.

Since natural gas production was scheduled to be increased in 1960 by 40 percent over 1956 and by 125 percent in 1965, gas pipe line construction was expected to be accelerated.

Again, as with most Communist-controlled data, no figures were available on actual natural gas production. Reportedly, the delivery of gas was increased six-fold from 1938 to 1955, and was to be further increased 2.4 times by 1960.

Czechs estimated that by 1965 30 percent of the population would have natural gas available as fuel.

Exploration. Obviously, oil plays a secondary role to natúral gas in Czech exploration activities, at least if announced results are indications. It appears that the nation's gas deposits offer an easier, quicker and less costly avenue toward realization than oil.

Years' long exploration activities near Bizens and Kostel have found more natural gas; therefore, more exploration has been ordered in the area. The region around Bratislava is another where activities are commencing.

Oil exploration reportedly is under way near Bernolakovo, east of the producing Stefanov field and near Petrova Ves and Brodska.

New Fields. The backbone of Czech oil production still remains the 20-year-old Goeding and Hodonin fields. At least, 1,085,120 barrels of oil came from them last year, for a combined total daily average output of almost 3000 barrels. The remaining fields were producing just enough oil to warrant commercial operation.

With what is described as just about Europe's most expensive oil—in relation to drilling and producing cost—little Czech money is available for extension of fields. However, a small number of fields was added during the past year. No information, however, was available as to whether they were producing economically.

Natural gas discoveries were found in the East-Slovakian Neogen horizons, the small Danube plains and the Vienna Basin, bordering Austria. Deep drilling tests near Lab and Vysoka also found natural gas. Stupava and Senec were mentioned as new gas fields, in addition to Bernokalovo and Malice.

The major field, however, is the area at the Austrian border, near the Austrian village of Zwerndorf. The field there has been put into the development stage, in deference to fears that Austria otherwise would alone benefit from this border-straddling deposit.

No new oil fields were reported last year, although the Stefanov field was extended in a westerly direction.

Economics. It is apparent that Czechoslovakia's liquid fuel requirements are covered 50 percent by domestic resources and that half of the requirements are furnished by imports. Of the 8.1 million-barrel minimum 1957 domestic requirements, Czechoslovakia likely would produce a maximum of 1.3 million to 1.4 million barrels of products from domestic crude and about twice that much from its

synthetic industry, with imports furnishing the difference.

Imports are furnished by Russia, i.e., Austrian reparation crude delivered to the USSR and sold by the Soviets to the Czech state. The 1955 Austrian oil imported through Russia amounted to 3.7 million barrels.

During 1957, Czech imports from Soviet sources (Austria, Rumania and Russia itself) were scheduled to be increased 100 percent, according to a Czech statement dated March 2, 1957.

It was believed that the wasteful coal hydration plant at Bruex would be ended since crude was being charged at the Bruex Stalin plant. The 4 million-barrel capacity there thus could be utilized fully to furnish 50 percent of the national products requirements. The plants at Pardubice and Bratislava, each of which has an annual crude charging capacity of about 1 million barrels, then would produce 25 percent of domestic requirements, thus enabling products imports to slide to about 2 million barrels.

Albanian Exports Expected To Increase

REVOLUTIONS IN POLAND and Hungary have left Albania untouched. Allegiance to the Kremlin, assured through President Enver Hoxsha, remains as strong as ever. No changes were expected in the government of this East Bloc-isolated country.

The domestic oil industry undoubtedly is profiting from Soviet supervisory action in that oil and gas are produced with Russian machinery and guidance, even though the products go directly to customers selected by Russia. Whereas several Soviet satellites saw Russian engineers, geologists etc. recalled on the request of Poland and others, Albania has made no move to have the Soviet staff reduced.

The overall oil trend is such that increasing production in other Soviet-controlled countries and apparently lower Soviet demands have permitted Albania to expand somewhat its oil business with Western countries. Therefore, it is expected that Albanian exports will be increased within the next few years owing to the establishment of refineries which will allow products exports.

Production. Hopes that the first actual figures on Albania's crude output would be released by the government last year were not fulfilled. As a result, two different production figures are offered for consideration by WORLD OIL.

1. The first—and most reasonable—production figure for 1956 is 2,441,000 barrels, or a daily average of 6670 barrels.

Support for this evaluated figure lies primarily in 1955 crude production as reported by the government and as reflected by the Statistical Bureau's fulfillment figure—1,870,500 barrels or 5125 barrels daily (See WORLD OIL, Aug. 15, 1956, Page 202). The 1956 increase over 1955 was claimed to have reached 30.5 percent, according to a Radio Tirana broadcast of Feb. 3, 1957, which would result in the 2,441,000-barrel figure.

The plan for this year called for a 6 percent increase from 1956, so the government expected that at least 2,521,500 barrels would be produced this year, tantamount to a daily average yield of 6880 barrels. Overfulfillment of the 1956 quota reportedly amounted to 3.5 percent last year; therefore, if the overfulfillment trend continued at the same rate for this year, a total 1957 crude output of more than 2.6 million barrels would be possible.

2. The second—and least likely—production figure for 1956 is 4,871,000 barrels, or a daily average of 13,300 barrels.

In 1955, Albanian politicians and some West European sources put Albania's crude production figure at 370,780 barrels, or almost 1015 barrels per day average. A 30.5 percent rise in 1956 over 1955—also claimed by some circles—would put last year's output at 4,871,000 barrels.

On this basis, the 1957 production plan, which called for a 6 percent increase in 1957 over 1956, would result in output this year climbing to 5,163,300 barrels—a daily average output of about 14,150 barrels.

Careful and methodical analyses conducted during the past several months have indicated that the first—or lower—figure of 2,441,000 barrels likely is nearer the truth. Primarily, this conclusion is based on the fact that Albania's annual domestic refining capacity has climbed to more than 2.3 million barrels, according to Albanian claims. And reports emanating from Tirana say "the vast majority of Albanian crude is now processed domestically."

Drilling. The most modern drilling equipment has been shipped by Soviet Russia to Albania to permit Soviet-supervised Albanians to step up drilling activity during the remainder of the current Five-Year Plan, which extends to 1960.

Exploratory drilling, according to Tirana reports, was scheduled to rise 178 percent over 1956, along with "a proportional amount of production footage."

It has been noted that drilling equipment used in Albania from 1945 to 1955 now is in poor condition. Imports of Soviet equipment, however, have replaced the U. S., German, French and Italian equipment used in the first ten post-war years.

Total footage, including exploratory and development, scheduled to be drilled during the Second Five-Year Plan was estimated in Western Europe to exceed the 1951-1955 footage by at least 50 percent in reaching 1,099,135 feet.

Pipe Line. The pipe line from Pathos fields, where the Cerrick refinery is located, to Stalin City was completed early in 1956. However, it has been found too small to move all the oil from the rapidly-expanding fields.

The government, during a Russian oil workers' visit in 1956, said "more pipe lines must be built." But no definite information on the locations or on the sizes of the projected pipe lines was available.

Exploration. Exploratory drilling was scheduled to be increased by 187 percent during 1960 as compared to 1956. This means either that greater attention is being paid to the increasing crude reserves or that current reserves are insufficient.

Exploratory work was being conducted in known producing areas rather than in new zones. The names

of Pathos, Kocova and Devoli, consequently, arise in any discussion of exploration operations, although the three fields are producing all domestic oil output.

New Fields. "Very rich" petroleum deposits were discovered in February, 1957, in villages around Pathos, according to Tirana sources. For that reason, Pathos producing area in 1957 had increased its output.

Near Berat, smaller deposits were found along the Osumi River and near Minari and Banja. In the latter cases, commerical production may not be possible.

Economics. There is little doubt that Albania has achieved greater prominence in Soviet Bloc oil business. A significant shift was made from exporting crude to the Eastern Bloc to refining Albanian oil domestically, and directing Albanian oil products shipments wherever needed.

The relatively favorable geographic location of Albania permits COMECON managers in Moscow to dispatch Albanian products via tankers to fleets of Eastern Bloc nations.

The importance of the oil industry was underlined by orders to increase 1960 crude production by 165 percent of the 1955 record. Special emphasis was being placed on refining expansion and on bitumen production.

One trend appeared clearly established: specialized products will continue to remain on the imports list, but the volume will be decreasing. Albanian crude oil and products exports will increase. The major question—will Albanian foreign trade shift more to the West?—appeared of slight interest since exports could not exceed 3.3 million barrels a year.

Bulgarian Oil Output Reaches 4100 BPD

BULGARIA'S PRO-MOSCOW government remained unshaken during the rebellion that rocked Communist rulership in Hungary and Poland during October, 1956. Minor unrest among students and the citizens of Sofia and Burgas was erased quickly.

Thus, Bulgaria's 7.3 million population remained politically, economically and culturally under the Russian thumb. And the oil industry is shaped by the fact that it receives all equipment from Russia or its satellite nations and that the major portion of its crude oil and products trade has been confined to the Eastern Bloc.

The newest trend, however, is born of the slightly more liberal treatment accorded the satellites by Russia. It reveals itself in increased offers of Bulgarian crude to Western markets and in attempts to buy more Western oil products.

Western experts and equipment, however, have been unable to penetrate the exploration and production fields of the industry, which are remaining shrouded in Red secrecy.

Production. Bulgaria has achieved notable success in oil industry development during the past five years. Germans, during World War II, and Czechoslovakians and Russians, during 1948-1950, failed in efforts to discover and develop Bulgarian oil. But the persistence of a handful of Bulgarian engineers and geologists, however, resulted in the discovery of deposits near Shabla and Tjulenovo, in the Dobrudga district, which were developed from 1953 to 1956. In this short period, the nation's crude output grew from practically nothing to more than 1.5 million barrels, or almost 4100 barrels per day. Traditionally small oil-producing countries such as Albania and Czechoslovakia have been unable to match this production rate.

Bulgarian sources claim that commercial deposits of oil have been discovered only at Tjulenovo and Shabla and that the Krstez deposit offers only fair promise. Natural gas is produced from oil wells near Tjulenovo, but it is vented into the air since no collection system exists. The gas production reportedly amounts to 353,140 cubic feet daily.

One gas producer was drilled on the left bank of the Kamshija River late last year.

Domestic crude production in 1956 reportedly amounted to slightly less than 1.6 million barrels, or 4371 barrels daily, as compared with 1 million barrels, or 2732 barrels a day, during the previous year. The 1954 output amounted to less than 535,000 barrels, or 1462 barrels daily.

Prior to 1954, only a small amount of oil had been produced from exploratory wells during 1951 to 1953.

Secondary Recovery. Bulgaria is using modern secondary recovery practices. During the first half of 1956, new wells were given acid treatments. Outstanding results were reported from 16 of the 18 wells treated, and production increases of up to 300 barrels daily were reported for some of the wells.

Depth of these producers ranges from 8200 feet to 10,500 feet.

Drilling. The greatest part of the $58,824,000 channeled last year into oil production operations was earmarked for exploration and development drilling. Western oil sources have expressed the belief that slightly more than 80 wells have been drilled in Bulgaria since the first well was spudded in near Shabla village, in the Dobrudga district, during the spring of 1951.

Only a small number of these completions are oil producers.

The first Russian turbodrill was delivered to Bulgaria in February last year, immediately after which the Liquid Fuels Enterprise, the government agency supervising the oil industry, opened a special course on turbodrilling for drilling personnel. The course was held at Stalin City.

Most of the drilling rigs in Bulgaria are of Soviet origin, including the UTZM, capable of drilling to 6560-foot depths, and the smaller BU-40 rigs, capable of drilling to 3500 feet. One Austrian Trauzel rig also has been reported operating in the Kamshija River area.

According to a May 30, 1956, dispatch from Sofia, Russia had exported radioactive core drilling rigs to Bulgaria for the first time.

Pipe Lines. The state plan for 1957, the final year of the current Five-Year Plan, called for the construction of a 93-mile crude oil pipe line from Tjulenovo field to the Black Sea village of Karvana, near Stalin City. This project was postponed from its original 1956 target date because the government elected to await development of additional crude production. No work had begun by mid-1957, however.

New Field. Plashkovo, a small village not far from Shabla, was described as

the sole 1956 oil discovery, with reports reiterating that only Tjulenovo oil field was of industrial importance up to mid-1957. Secrecy continued to shroud any progress on the development of this field.

Exploration. Exploration activities were moving slowly because of the lack of sufficient funds to conduct larger-scale operations. Several parties were operating near known deposits during 1956 and 1957.

Former Premier G. Chankov was cited in 1955 as having "known Bulgarian deposits are yet too small to warrant higher investments in the oil business." Bulgaria has not even financed exploration operations sufficiently to work out a sound oil reserve from which larger sized production could be expected.

The slight amount of geophysical activity possible under tight budgets is directed primarily along the Kamshija River in an area of the Devon structure, where natural gas was discovered in 1956.

Geophysical work last year, which was being conducted near the Rumanian border, has not been mentioned since the initial report.

Economics. Bulgaria's crude production of 1.6 million barrels was able last year to fulfill 23 percent of total domestic requirements, according to Foreign Trade Minister Rajko Damjanov, who said that "imports of oil products had to cover 77 percent (5.3 million barrels) of requirements."

Other official Bulgarian statements said, however, that the crude production in 1956 was sufficient to supply 40 percent of the country's oil needs. Apparently, the shortage of refining capacity accounted for the gap between the 23 percent reference and the 40 percent claim.

The oil industry so far has been neglected by state authorities, as indicated by the insufficient allocation of funds to the industry—from exploration all the way to refining. The decisive change was expected during 1957, when more equipment was scheduled to be imported, greater allocation of funds for exploratory work was to be considered and when the Russe refinery was scheduled to undergo expansion and modernization.

It is claimed that Bulgarian crude is in demand in Austria, West Germany, Italy and Greece. Initial consignments already have been delivered to Greece and to West Germany, with whom Bulgaria would like to exchange crude oil for refined products.

Reportedly, West German tests have indicated that Bulgarian crude is usable—without extensive refining—in heavy stationary diesel engines and that it contains little sulfur and solid impurities.

The Bulgarian trend is toward the purchase of more oil products in other than East Bloc countries. This is evidenced by the nation's expressed interest in Austrian, Yugoslavian and Greek oil products. Trading with the West was generally indicated by a 57 percent increase in the exchange of goods during the 1954-1956 period.

The nation is depending on increasing products imports, owing to the rising domestic requirements. The following 1950-1955 increases in the various segments of Bulgaria's economy were likely to be exceeded in the 1957-1960 period: a 200 percent increase in agricultural output, 2.2 percent rise in heavy industry, and 11.35 percent boost in transportation.

During 1956, agricultural enterprises required approximately 40 percent of domestic requirements; heavy industry, 8.5 percent; and transportation, about 18 percent.

Since there is almost no private motoring in Bulgaria, the remainder of about one-third of Bulgaria's oil needs undoubtedly was earmarked for the military establishment.

Hungary Output Drops in Rebellion Year

HUNGARY's 1956 crude production was doomed to remain at a level far below the 1955 output of about 12.2 million barrels (See WORLD OIL, Aug. 15, 1956, Page 188) long before the October rebellion began. Nagylengyel field, pride of the Communist government, had begun to produce increasing amounts of water in January, 1956, because Soviet operations produced the area at a rate considered 100 percent too fast for orderly development. Then, of course, the peoples' rebellion also affected the annual output.

This rebellion, sparked by university students and joined readily by the laboring element, was a rebellion not only on the political level but also against everything connected with the Russians and their ideology. The oil fields were but one segment of the economy where Marxist principles disproved themselves. The Soviet rule of forcing production managers to steadily increase production regardless of quality in fear of bodily harm was applied to the fullest extent in the Nagylengyel oil fields.

Production. Hungary's 1956 crude production reached a maximum of 7,630,000 barrels, or an average daily rate of about 20,850 barrels as compared with 12,208,000 barrels, or an average daily yield of about 33,450 barrels, for the previous year.

Two reasons responsible for this decrease in output were:

- Rapid water encroachment of Nagylengyel oil fields.
- Hungarian rebellion, which interrupted transportation facilities for weeks and forced a partial shutdown of producing wells.

The crude production record established in 1955—12,208,000 barrels—amounted to 1,526,000 barrels more than demanded by the original 1955 quota. The increase resulted from Premier Rakosi's own order after he learned about the rapid development of Nagylengyel, which was begun in late 1951 as far as test drilling was concerned.

Soviet and Hungarian engineers had developed daily output at Nagylengyel of about 140 barrels during 1952, increasing it to 7900 barrels in 1953, 16,500 barrels in 1954, and a peak of 25,484 barrels during 1955. The 1956 yield, owing to water encroachment and the rebellion, slipped to a daily average of 18,632 barrels.

In converting metric tons to barrels, arbitrary conversion factors or those of the U. S. Bureau of Mines are used in the U. S. As a result, there usually is a marked discrepancy between any two sets of figures in relation to Iron Curtain countries. That, of course, is because the specific gravities of the crudes, which determines the conversion factor are not known. The Bureau of Mines indices, based

on pre-war crudes, no longer are valid since current crudes differ greatly in their composition from those produced before the war.

Hungary is a case in point. Production in 1956 amounted to 1 million metric tons. Using the conversion factor of 7.630 (barrels per metric tons), 1956 production in barrels is figured at 7,630,000 barrels, or about 20,850 barrels per day.

However, some sources put Hungary's daily average last year at 2442 metric tons. Using the same conversion factor, the average daily output is figured at 18,632 barrels—a difference of 2218 barrels per day.

However, on the basis of the currently-used conversion factor, production in January, 1957, had decreased to a daily average of slightly more than 9000 barrels.

During a low production period, geologists ordinarily take advantage of the opportunity to evaluate oil fields and to study the fields' prospects; however, such efforts are described by Soviets as "unproductive." Hence, no one knows how extensive a producing area Nagylengyel is. Hungary's two other producing fields —Budafa and Lovaszi—also reflected a decrease during 1956.

Budafa, producing a daily average of 36 barrels in 1937, reached the following levels during the 1938-1943 period: 778 barrels, 2579 barrels, 5143 barrels, 5913 barrels, 6234 barrels and 5509 barrels. Post-war development in the fields included these daily averages from 1949 to 1956, respectively: 3632 barrels, 3548 barrels, 3128 barrels, 3365 barrels, 2945 barrels, 2648 barrels, 2411 barrels, and 2075 barrels. It is apparent that the field was declining.

Lovaszi, which was discovered by Germans in 1940, produced a daily average of 114 barrels during that year, increasing to 2877 barrels in 1941, 7088 barrels in 1942, and 10,377 barrels in 1943. The following production figures were recorded for the post-war period 1949-1956: 5929 barrels, 5425 barrels, 5562 barrels, 5669 barrels, 5333 barrels, 4937 barrels, 4441 barrels, and 3425 barrels. That indicated Lovaszi also was declining through natural depletion.

Total Hungarian production per day—stemming from Nagylengyel, Budafa, Lovaszi, and the minor fields of Kischehi and Mezoekeresztes—from 1949 to 1956 is as follows:

Hungarian Crude Production, 1949-1956

Year	Daily Average Production (in barrels)
1949	10,613
1950	10,735
1951	10,605
1952	12,559
1953	17,785
1954	25,522
1955	35,520
1956	25,133

While oil workers participated in the rebellion against the Kremlin-minded Hungarian Communists, damage done to fields was described as negligible. Of course, production dropped because producing well controls were shut off and, as indicated, transportation difficulties mounted.

The natural gas supply, however, was maintained at pre-rebellion rates throughout the period.

Current daily output was averaging about 15,000 barrels at midyear, which indicated that total 1957 production would be below the 7 million barrel level (19,000 barrels daily).

Drilling. Soviet and Rumanian drilling rigs were used at 17 separate locations in Hungary last year. The initial consignment of four Soviet turbine rigs was received during mid-1956.

Plans called for the drilling of 4 million feet of hole in exploratory tests in the current (1956-1960) Five-Year Plan. But fulfillment of this demand was uncertain, owing to partly obsolete exploration and development drilling equipment and shortage of foreign equipment's spare parts.

It was estimated that 12,000 drilling bits would be required for wildcatting alone; however, Hungarian oil companies had not been advised when the bits would arrive or from whence they would come. Although 360,000 sacks of cement were assured, the required 4 million feet of casing also remained a question.

But the greatest difficulty was the lack of foreign currency with which domestic companies were to buy foreign machinery and equipment.

An attempt to drill Europe's deepest well was made during August, 1956. The hole had reached 13,025 feet when the drill shaft broke immediately above the bit.

Drilling operations were under way by the end of 1956 north and west of the Nagylengyel field. Six wells were completed there during 1956, and more were planned in the northwest and southeast directions, i.e., Zalahasagy, Barabasszeg and Nagytilaj.

Reports that oil had been discovered in the northern and northwestern areas just off Nagylengyel were found untrue.

No plans for 1957 drilling had been established, so local drilling companies were drilling at a rate equal to fund allocations.

Four more Soviet turbodrill rigs were expected to be delivered in the last quarter of 1956, but their arrival had not been announced. More turbine rigs, for drilling below 10,000 feet, were received during June, 1956, according to Hungarian Planning Minister Arpad Kiss.

The drilling plan for 1956-1960 was announced at 3,937,200 feet.

Exploration. It is typical that Communist economic thinking would call for exploration in the area of known deposits rather than in areas in which such operations would require more money, equipment and manpower. Consequently, Hungarian geological activity during 1956-1957 was confined to areas surrounding the producing Nagylengyel field and in the neighborhood of the 1956 discovery—the Demjen field in northern Hungary.

Exploration activities also were centered around Zalahasshagy, Barabasszag and Nagytilaj, where altogether six wells were being drilled. About 150 persons were active in exploration, operating seven drilling rigs and six seismic parties.

Most of these drilling rigs were operating in Zala country, in an area located between Gellenhaza and Nasad. The parties are equipped with Soviet tractors, cars for explosives, radio communications, etc.

Other exploration areas are Eger, Babcosa, Toertel, and Demjen, near Eger city.

New Field. The Demjen field went into production last year, but its percentage of total domestic output was insignificant. Located near Eger in Northern Hungary, the field produces light oil.

Economics. Since coal, wood, electric power and peat production slowed down during the rebellion and increased to a level below the pre-rebellion figures since October, 1956, oil as a fuel has risen to an eminently important position.

Russians, realizing this, agreed to

export to Hungary 6.8 million barrels of oil in excess of the 1.1 million barrels already contracted under the 1957 trade agreement.

Difficulties arose in Hungary's shortage of tank cars and in the inability of Hungarians to transfer Soviet oil from the wide-gauge Russian rail tracks to the normal gauge tracks used in Hungary.

A transfer plant was built quickly in Komoro at a cost of $428,000 whereby a daily volume of between 16,500 barrels and 18,500 barrels could be transferred into the normal gauge track tank cars.

Western observers believed Russia had another reason for erecting the transfer station. Since the capacity likely will exceed Hungary's domestic crude production within a short while, the station could be used for moving East European oil to Central and West European markets.

While Hungarian oil experts doubt the existence of oil below the 9850-foot level, they agreed to drill deeper on Soviet geologists' suggestions. Russians pointed out that 13 miles south of Zala country, Yugoslavia was drilling and producing succesfully.

Exports and Imports. The 1956 production of 7,630,000 barrels and Soviet-ordered imports from Austria amounting to slightly more than 1 million barrels, in addition to more than ¼ million barrels of imports from Bulgaria and about 1.5 million barrels imported from Rumania were required to meet Hungary's domestic crude requirements.

The actual 1957 demand is expected to range up to 13.7 million barrels, higher by 2.3 million barrels than the pre-rebellion estimate. Only about 5.3 million barrels were anticipated from domestic fields, leaving a margin of at least 8.4 million barrels.

Russia has agreed to export to Hungary 6.5 million barrels, with the balance being furnished by other sources. Because of the lack of Western currency, the remainder likely will be furnished by Rumania and, to a smaller degree, by Bulgaria.

Rumania's Oil Output Rise Levels Off

RUMANIA'S POST-1948 rising crude production trend almost reached a standstill in 1956. This occurred despite the top priority status given the oil industry both by the government and the Communist party, which together allocate funds and equipment imports and which control the mobilization of labor. Although four new fields were discovered last year, production remained stationary. Too, an ever-increasing percentage of the nations oil output is being supplied through the application of secondary recovery practices.

This slackening began in 1953, when figures from the West German Institute of Economic Research listed production at 67,338,795 barrels, or almost 185,000 barrels per day. At that time, figures evaluated from Western reports and Eastern claims put annual production at 70,632,500 barrels, or 193,500 barrels daily (See WORLD OIL, Aug. 15, 1956, Page 195).

Thus, it appeared doubtful that the 1960 goal of 100,372,500 barrels annually, or 275,000 barrels per day, would be reached. That level was foreseen in the planned objectives for the end of the Second Rumanian Five-Year Plan.

Rumania produced 81,386,760 barrels of oil last year, equivalent to 222,368 barrels daily, or only—about 7000 barrels per day more than during the preceding year. The 1955 yield has been confirmed at 78,815,475 barrels, or slightly more than 215,000 barrels daily.

While last year's production was significantly greater than that of the last pre-war year (1937), it still was below the government-imposed quota. The reduced annual increase rate last year of 3 percent indicated economic difficulties, for the increase in 1954 as compared with 1953 amounted to 7.5 percent and the rise in 1955 over 1954 amounted to approximately 8 percent.

The decline of Rumanian crude production just about coincides with the retreat of Russia from the direct co-management of Rumanian oil fields. Naturally, it could not be determined whether the Soviets left because they knew of the difficulties which lay ahead or whether Rumanian production methods call for the exercise of greater care in producing the oil fields than did the well-known Russian techniques.

Rumanian oil technicians have been using these means to increase the nation's oil output, in addition to discovering minor new fields:

- Secondary recovery practices are being used generally. At Boldesti, both gas and water lift are being used to produce all possible oil from wells which were idle for the past 20 years.
- Pump station capacities are being increased.

Reports of field operations last year pointed to progress which has been made since secondary recovery programs began in earnest during the second half of 1950. Forty-six wells in nine fields currently are furnishing 30 MMcf of natural gas a day and 116 wells in ten other fields are furnishing a total of 710 Mcf daily for the spreading gas-injection program. Thirteen compressor stations have been built, each with a daily capacity of 11 MMcf, and an undisclosed number of water injection stations have been installed. Each of the latter group has a 2¼ million gallon capacity daily.

Secondary recovery is credited with furnishing about 12 percent of total annual output, or a total of 9,766,411 barrels during 1956 (26,684 barrels daily).

Hydrofacing has been used since the fall of 1954 at the Bustenari field. A total of 334 wells were subjected to hydrofacing during 1955 and 1956, especially in the Moldovia district. Reportedly, about 85 percent of these treatments proved successful, improving the production of some wells by 100 percent to 200 percent. Additional production in the Moldovia district of 8 percent was credited to this treatment.

Drilling. Information concerning the Rumanian oil industry has become scarcer by the month. Lack of any spectacular development may be the prime reason for this absence of information. News of the oil industry was plentiful while the industry's trend was on the rise.

Last year's drilling operations were characterized by the high cost of operations, an inability to fulfill the footage quota, lack of spare equipment parts, and the shortage of funds.

The high operational cost stems

from poor transportation means, poor roads and lack of vigilance on the part of administrative managers.

The drilling quota has not been fulfilled for the same reasons, in addition to reduction of investment funds. Consequently, the 1960 plans were believed to be in need of revision. In general, the drilling companies are working at a cost in excess of original allocations rather than fulfilling the government-ordered cost reductions.

In view of the secrecy shrouding actual oil industry operational data, little credence can be placed on the percentage figures used by Russia and its satellites. Consequently, the exact amount of footage drilled in Rumania last year cannot be pinpointed. However, claims have been voiced that exploration footage was exceeded by 14 percent in 1956 from 1955. No reports of development drilling were available. However, the planned quota for 1955 included 2,296,588 feet of development drilling and 1,804,462 feet in exploratory drilling (See WORLD OIL, Aug. 15, 1956, Page 196).

Therefore, if the quota was met—and that is questionable—total exploration footage in 1956 would have amounted to 2,057,086 feet. And if no increase were recorded in development drilling over the 1955 quota, total footage in 1956 would have amounted to 4,353,674 feet.

That it is unlikely that this amount of footage was recorded last year is indicated by the statement made during that period by Minister Dumitru. He said drilling was being pursued on a 60-40 ratio of exploration/development drilling. In 1953, the minister said the ratio was approximately 60-40.

During the year, Rumanian engineers reportedly developed their gas drilling technique. This method was to have been used initially in the Sarata-Monteoru fields.

So-so results are indicated in the current practice of transporting entire drilling rigs, with all engines and equipment mounted in the derrick's base plate, to new locations. Rigging-up time is reported at about 10 days.

While this transportation practice has been advantageous, final results have been tempered by the sub-par quality of equipment. Moinesti field engineers reported 916 breakdowns in August, 1956. During September, Oltenia field engineers admitted that drilling costs were 20 percent above the planned limits, and that the footage in the field failed by 34 percent of meeting planned objectives.

The Soviet Union promised on Dec. 12 last year that more drilling equipment and more experts would be sent to Rumanian oil fields in 1957. Thus, it appeared that the Rumanian oil equipment industry (formerly the joint Sov-Rum Utilay Petrolifer) has been unable to maintain the level of quality reached under Soviet management.

Pipe Line. Rumania's only pipe line begun last year was the dual natural gas line from Siebenbuergen gas fields to Bucharest, the capital. These lines were to cross the Transylvanian Alps, and were to have lateral lines to Banat, Moldovia and Muntenia districts. The Bucharest pipe line system was increased 56 miles in the past three years, with the number of consumers tripling during the period.

Exploration. It was apparent that an even stricter policy on oil industry reporting was being followed, since no information was available on geophysical or other exploration operations last year.

New Fields. Four new and apparently minor fields were developed last year:

1. Two separate fields located at Petesti, north of Ploesti.

2. Northern Moldovia field.

3. Constanza (harbor) field.

No further data were available on the producing capacity or status of these fields.

Economics. Rumania remained as the major Soviet-declared oil and products exporter, both to fellow-satellite nations and to Western countries. Russia still enjoys priority delivery status, however, and is able to maintain or increase shipments of Rumanian crude or products to other countries. But the near-stationary crude output, coupled with increasing domestic requirements, is narrowing down the nation's ability to satisfy domestic market outlets.

A Rumanian government delegation under Prime Minister Stoica Chivu reached Moscow early this year to argue that Soviet prices paid for Rumanian oil must be raised. This is of some significance since the minister must feel strongly about the need in order to seek out the Kremlin.

The Soviets, binding Rumania over to deliver unknown amounts of crude and products either to Russia or to nations named by it for an unknown—but certainly insufficient—price have made Rumania pay dearly for whatever the Soviets did in "aiding" the richest oil nation of Europe.

The Rumanians, however, still have a smaller portion of domestic production free to export. These exports, necessary to earn needed foreign currency, cut down the available domestic supplies.

A trend toward higher Rumanian exports to the West was recognized during 1956 and early 1957. In the case of Finland, difficulties have arisen over Rumanian demands for direct dollar payment instead of Soviet currency. This latter currency was allocated Rumania by the Soviets from the monetary gap created between Finnish exports to Russia and that country's Soviet imports.

Other importers of Rumanian oil and products are India, France and Egypt. The latter agreed to buy Rumanian kerosine, gasoline and other oil products, oil exploration equipment, and rolling stock, and 20 days later 14 tankers loaded with oil products left Constanza harbor.

Poland Production Reaches 3723 BPD

IRONICALLY, a Catholic cardinal is preventing traditionally-religious Poland from becoming completely subservient to Russia. In urging Poles to listen to national Communist W. Gomulka since the bloodless revolution of October, 1956, Cardinal Wishinsky (no relative of former Soviet Minister Vishinski) has extracted the greatest freedom for the church of all Soviet satellite countries. By advising Poles to be quiet and to listen to Premier Gomulka and his anti-Moscow party leaders, the cardinal has further secured his own position.

The difficulties that have arisen from Poland's new status—of opposition to the Kremlin—however, have led to severe difficulties in the nation's economy. U.S. credits amounting to $100 million have not altered

Poland's precarious economic position.

The Polish oil industry, although untouched by the rebellion and the immediate shift in government policy, was appearing to suffer for lack of funds and shortage of spare parts for Soviet-delivered industrial equipment.

Production. Reportedly a 9 percent overfulfillment of the government's 1956 production quota had been achieved, with total output amounting to 1,362,773 barrels for the year, or a daily average of slightly more than 3723 barrels.

This official claim is barely half of the production level claimed for 1955.

The Polish Statistical Yearbok lists the following production figures for indicated years:

Year	Production (in barrels)	Daily Average (in barrels)
1946	863,571	2,366
1947	952,599	2,609
1949	1,123,978	3,079
1953	1,400,717	3,837
1954	1,362,870	3,733

Late last year, the Polish *Naphtha Journal* reported that crude production in 1955 amounted to 1,335,420 barrels. Thus, 1956 output of 1,362,773 barrels appears plausible. Not so, however, is the Polish 1955 claim that production during that year amounted to 2,863,912 barrels. The 1956 domestic output would cover about 12 percent to 13 percent of the year's domestic requirements.

Natural gas production last year was reported at 15.4 billion cubic feet, or an apparent 4.5 percent overfulfillment of the state-imposed quota.

Drilling. Total footage drilled during 1956 amounted to 276,355 feet. Of that amount, 264,357 feet resulted from exploratory wells and 11,998 feet stemmed from development drilling. Informed sources estimated that approximately 70 wells were completed last year. That would put the average depth per well figure at about 3860 feet.

However, the government's drilling quota was not reached. The drilling footage figure represented 90.3 percent of the quota.

The 1957 exploratory drilling program calls for:

- Geological, geophysical and drilling operations in the North Polish lowlands, from Niecki Lodsko to Stettin, and the East Sudeten monoclines.
- Drilling activity at Holy Cross Mountains, southwest of Solce village.
- Drilling in the Carpathian Mountains, in the Strzyzov depression.
- Drilling operations in the Mielec-Niwiska area of the Carpathian Mountains and on the Lublin plains.
- Study aimed at determining technical requirements for drilling to depths below 9800 feet.

Further, the First Five-Year Plan of Poland has called for an increase in footage drilled amounting to 150 percent in 1960 as compared with the 1955 total.

Pipe Lines. The 1957 pipe line projects all deal with natural gas transmission. In two existing lines—the 18-mile Haczov-Krosno pipe line and the 25-mile Gliniczek-Pilzno pipe line—increased capacity was scheduled this year through the installation of additional compressors. Also, a pipe line was planned between Warzyce and Krosno, and the pipe line from Gliniczek to Kovalovy was to be replaced.

General Economics. The Central Oil Administration (Centralny Urzad Naftowy), founded as an independent economic administration on April 18, 1955, was dissolved as of April 5, 1957, by government decree.

The COA emerged as a department of the Ministry of Mining and Energy Business as a result of streamlining of economic administration. While the oil industry, through the COA, had had a direct line of communications and rank with the Council of Ministers (the COA enjoyed "Department" rank), the new setup provides that oil, as a part of primary energy production, be dealt with at equal ranking with coal, electric power, etc. Meanwhile, reports were circulating that the government intended to abolish the COA.

One such report hinged on the fact that oil industry progress has not been as successful as the government had hoped, and that the oil industry, therefore, lost its priority status.

Another report was based on the new economic policy, which aims at giving greater room for decision to production unit managers rather than to ministries.

The latter policy is to make each production unit desirous of attaining the greatest possible individual yield instead of simply fulfilling planned norms.

Failure to fulfill only 94 percent of domestic requirements last year was blamed on the Hungarian rebellion that disrupted transportation and prevented deliveries of Rumanian crude stocks. Since only about 12 percent of the actual 1956 consumption of products was processed from domestic crude, gasoline rationing was ordered. Extent of the rationing order was that only 80 percent of the usual amount of available retail gasoline was allocated for both state and private vehicles. Private consumers' rations amounted to 1.5 gallons per car daily.

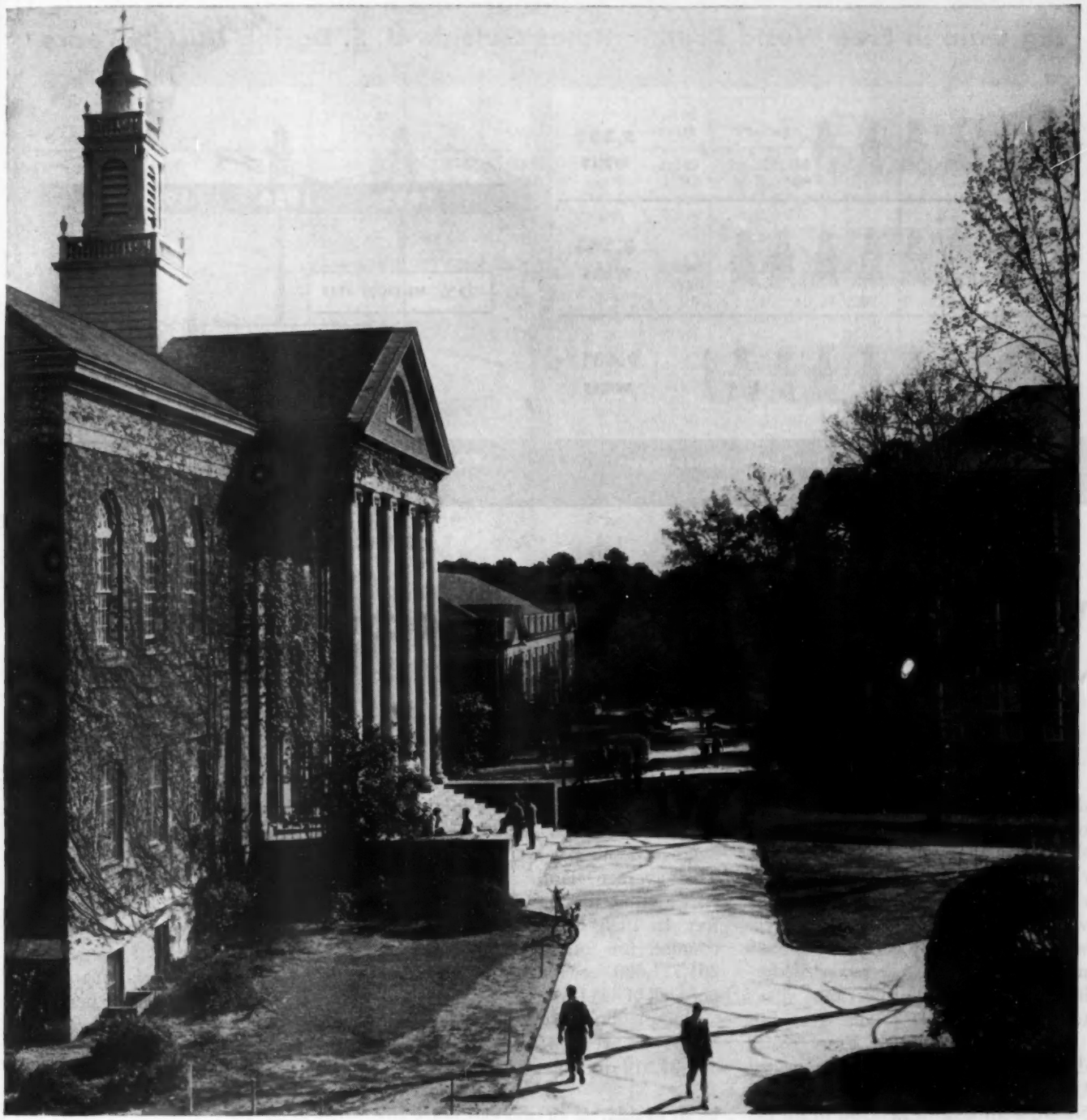
Exports and Imports. The 1955 imports of crude oil amounted to about 3.8 million barrels, of which 2.9 million barrels were supplied by Russia. The 1956 figures, although not released by the Polish government, are believed to be almost 4 million to 4.1 million barrels greater than during 1955 because of the general upturn in domestic requirements and the level of domestic production.

To what extent Russia increased its exports to Poland during 1956 is not known; however, a 1 million-barrel-plus increase in Russian imports was announced for 1957. This increase apparently was aimed at erasing the 1956 cutback in Rumanian exports due to the Hungarian rebellion. Imports of crude oil from Russia amounted to 3.2 million barrels in 1954.

An over-all evaluation of the 1957 oil business indicated that Poland could expect domestic production of about 1,483,800 barrels, or a daily average of less than 4100 barrels. In addition, the nation will import about 4.5 million barrels so that its refining capacity can be fully utilized.

With 1957 requirements of crude and oil products expected to exceed 14.8 million barrels, Poland also will import crude products, primarily from Russia, Rumania and Austria.

—The End



"Business has a very particular interest in education . . . not only for the purpose of improving efficiency and profits, but more largely because it carries such a heavy responsibility toward our society. To discharge that responsibility we must have more and better educated people to give leadership, direction, inventiveness and understanding in our business world."

M. J. Rathbone, President, Standard Oil Company (New Jersey)

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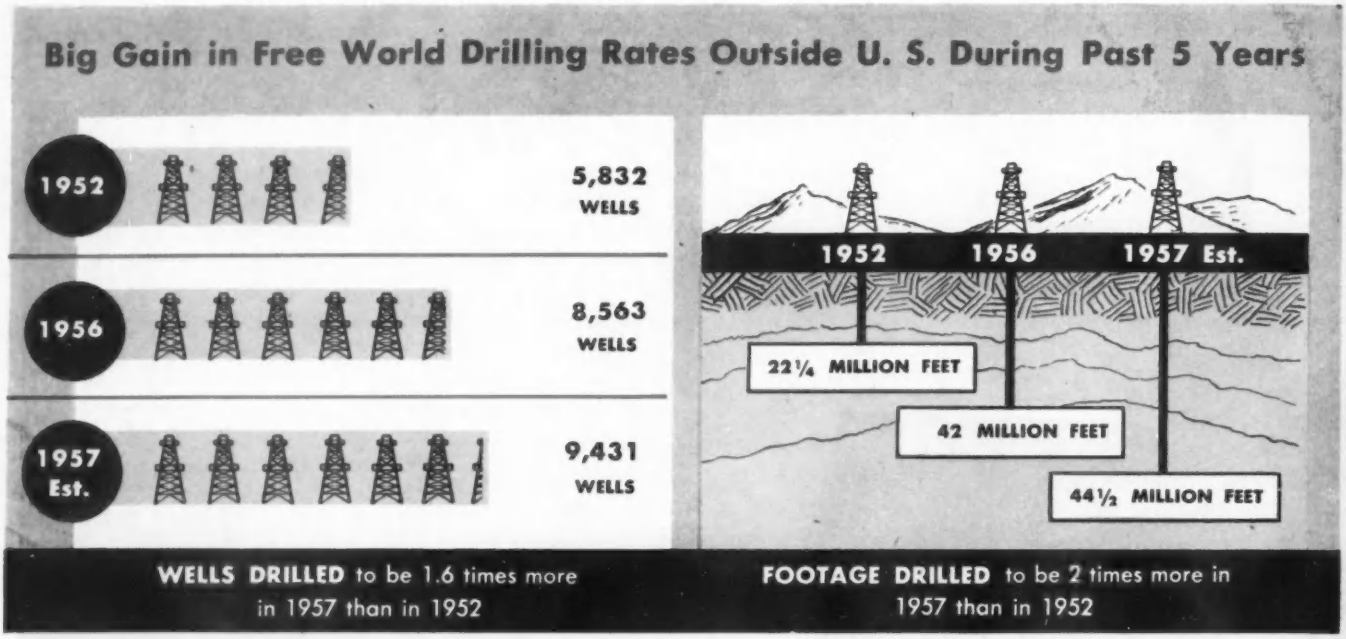

Big Gain in Free World Drilling Rates Outside U. S. During Past 5 Years
1952
5,832 WELLS
1956
8,563 WELLS
1957 Est.
9,431 WELLS
1952
1956
1957 Est.
22¼ MILLION FEET
42 MILLION FEET
44½ MILLION FEET
WELLS DRILLED to be 1.6 times more in 1957 than in 1952
FOOTAGE DRILLED to be 2 times more in 1957 than in 1952

World Completions and Footage . . . Total of 65,101

wells forecast for Free World during year.

A TOTAL OF 65,101 wells will be drilled in the Free World, exclusive of Russia and its satellite nations, by the end of the year, WORLD OIL forecasts. This estimate indicates a decrease of 2.9 percent, or 1880 fewer wells, from 1956, when 66,981 wells were completed. By comparison, 3323 more completions were recorded during 1956 than the previous year's total of 63,658 wells.

Decrease in over-all Free World drilling stems from a drop in expected U. S. drilling rates this year—from 58,418 completions in 1956 to an expected 55,670.

However, drilling activity for the Free World, outside the U. S., was expected this year to account for the completion of 9431 wells, 868 more than were drilled during 1956—an increase of slightly more than 10 percent.

Thus, the margin of difference between WORLD OIL's previous forecast of 67,610 completions and the reporting of 66,981 actual wells drilled during the year amounted to 0.9 percent.

The 1957 forecast will mirror a downturn in the footage drilled figure for the year, a major factor in evaluating drilling activity. In 1956, the Free World accounted for total footage drilled of 277,550,826 feet for an average depth per well of 4144 feet. This average depth showed an increase from the previous year of 33 feet. In 1955, 63,658 completions accounted for total footage drilled of 261,721,660 feet for an average depth per well of 4111 feet.

Completions during 1956 resulted in 36,951 oil wells, 4512 gas producers and 25,518 dry holes.

U. S. Leads. As in previous years, the forecast anticipates that a large part of the expected drilling will occur in the U. S. (55,670 wells) with 9431 completions spread throughout the remainder of the Free World.

With a 9.2 percent anticipated increase in Canadian drilling operations and a 15.7 percent rise in Mexico's forecast, North America, excluding the U. S., is expected to account for 4670 completions by year's end. With Venezuela drilling anticipated to increase by more than 17 percent from 1956, South America is expected to record a total of 2846 completions this year. Venezuela, again with the third largest drilling program in the world, is expected to complete 1700 wells by year's end, as compared with 1449 wells drilling during the past year.

Thanks largely to Western Germany, Western Europe had a firm hold on the No. 3 position in worldwide drilling. Expected to complete 550 wells this year, 32 more than during 1956, Western Germany likely will furnish more than 50 percent of the continent's anticipated total of 1085 wells. In 1956, when Western Germany recorded 518 completions, the region accounted for a total of 979 wells.

A significant gain is expected in Africa because of the recent oil discoveries, particularly in North Africa. With 100 wells forecast for Algeria and Morocco by year's end, Africa is expected to record a significant increase of 61 completions from 1956 (almost 39 percent) to a total of 215.

Only 219 wells are forecast for the Middle East, where the largest share of the world's oil is found. Three hundred and eighty-eight wells is the total forecast for the entire Far East and Oceana.

Footage Drilled. Exclusive of the U. S., where 1956 footage drilled

FREE WORLD DRILLING ACTIVITY

(Exclusive of U.S.S.R. and Satellites)

COUNTRY	Forecast Wells in 1957	1956						1955	
		Oil	Gas	Dry	Total Wells	Footage	Average Depth	Wells	Footage
North America, Excl. U.S.	**4,670**	**2,645**	**388**	**1,214**	**4,247**	**18,221,316**	4290	**3,596**	**14,633,182**
Canada	4,075	2,395	336	1,002	3,733	15,736,623	4216	3,165	12,569,441
Cuba	120	30	1	73	104	272,597	2621	95	249,831
Mexico	470	220	51	135	406	2,172,387	5351	330	1,789,805
Other North America	5	.....	....	4	4	39,709	9927	6	24,105
South America	**2,846**	**2,186**	**24**	**426**	**2,636**	**15,040,039**	**5706**	**2,354**	**11,608,161**
Argentina	300	227	....	71	298	1,673,000	5614	259	1,486,182
Bolivia	20	20	....	5	25	107,282	4291	21	75,878
Brazil	60	32	1	12	45	229,547	5101	73	174,281
Chile	66	18	16	30	64	410,251	6410	58	389,740
Colombia	140	99	1	38	138	815,479	5909	117	725,905
Ecuador	85	133	2	21	156	300,739	1928	216	332,200
Peru	190	154	1	44	199	798,389	4012	219	894,589
Trinidad	285	225	3	34	262	1,110,745	4239	228	987,567
Venezuela	1,700	1,278	....	171	1,449	9,594,607	6622	1,163	6,541,819
Central America	**8**	**1**	....	**8**	**9**	**55,186**	**6132**	.....	.....
Western Europe	**1,085**	**495**	**100**	**384**	**979**	**4,757,457**	**4860**	**1,111**	**4,436,073**
Austria	175	126	4	14	144	740,247	5141	123	584,348
France	115	22	3	82	107	582,837	5447	92	439,975
Germany, West	550	311	35	172	518	2,322,779	4484	567	2,409,140
Great Britain	30	9	....	10	19	70,320	3701	26	70,475
Greece	5	.....	....	1	1	4,589	4589	.....	.....
Italy and Sicily	165	18	58	83	159	884,900	5565	276	821,085
Netherlands	28	9	....	5	14	94,458	6747	17	70,800
Portugal	1	.....	....	1	1	7,010	7010	.....	.....
Spain	15	.....	....	16	16	50,317	3145	10	40,250
Switzerland	1	.....	....	.....	.....	.....	.....	.....	.....
Africa	**215**	**55**	**9**	**90**	**154**	**1,499,566**	**9737**	**131**	**634,495**
Algeria	75	12	5	39	56	318,808	5693	44	228,361
Egypt	10	15	....	2	17	127,169	7481	13	29,600
Morocco	25	7	....	14	21	113,384	5399	39	184,890
Tunisia	3	.....	....	4	4	37,908	9477	6	35,566
Other Africa	102	21	4	31	56	333,105	5948	29	156,078
Middle East	**219**	**130**	**3**	**31**	**164**	**977,527**	**5961**	**113**	**543,036**
Bahrain Island	20	21	....	.....	21	50,510	2405	15	58,069
Iran	15	3	....	.....	3	15,571	5190	8	21,200
Iraq	15	8	1	3	12	137,487	11457	20	140,133
Israel	32	12	....	11	23	139,817	6079	.....	.....
Kuwait	30	25	....	.....	25	136,963	5479	22	96,000
Neutral Zone	35	26	....	3	29	83,985	2896	15	58,754
Qatar	8	1	....	4	5	39,868	7974	9	54,720
Saudi Arabia	25	15	....	*5	20	124,713	6236	7	48,000
Turkey	30	7	....	.....	7	52,769	7538	16	53,660
Other Middle East	9	12	2	5	19	195,844	10308	1	12,500
Far East and Oceania	**388**	**247**	**44**	**83**	**374**	**1,613,294**	**4314**	**474**	**1,337,025**
Australia	7	.....	....	28	28	70,102	2504	36	150,289
Indonesia	150	125	3	10	138	473,938	3434	133	266,863
Japan	130	55	40	31	126	680,449	5400	218	547,097
New Guinea	8	4	....	.....	4	9,841	2460	20	52,133
New Zealand	1	.....	....	.....	.....	.....	....	1	3,000
Sarawak-Brunei (Br. Borneo)	40	36	....	9	45	278,813	6196	34	209,861
Other Far East	52	27	1	5	33	100,151	3035	32	107,782
Total Free World Outside U.S.	**9,431**	**5,759**	**568**	**2,236**	**8,563**	**42,164,385**	**4924**	**7,779**	**33,191,972**
United States	**55,670**	**31,192**	**3,944**	**23,282**	**58,418**	**235,386,441**	**4029**	**55,879**	**228,529,688**
Total Free World	**65,101**	**36,951**	**4,512**	**25,518**	**66,981**	**277,550,826**	**4144**	**63,658**	**261,721,660**

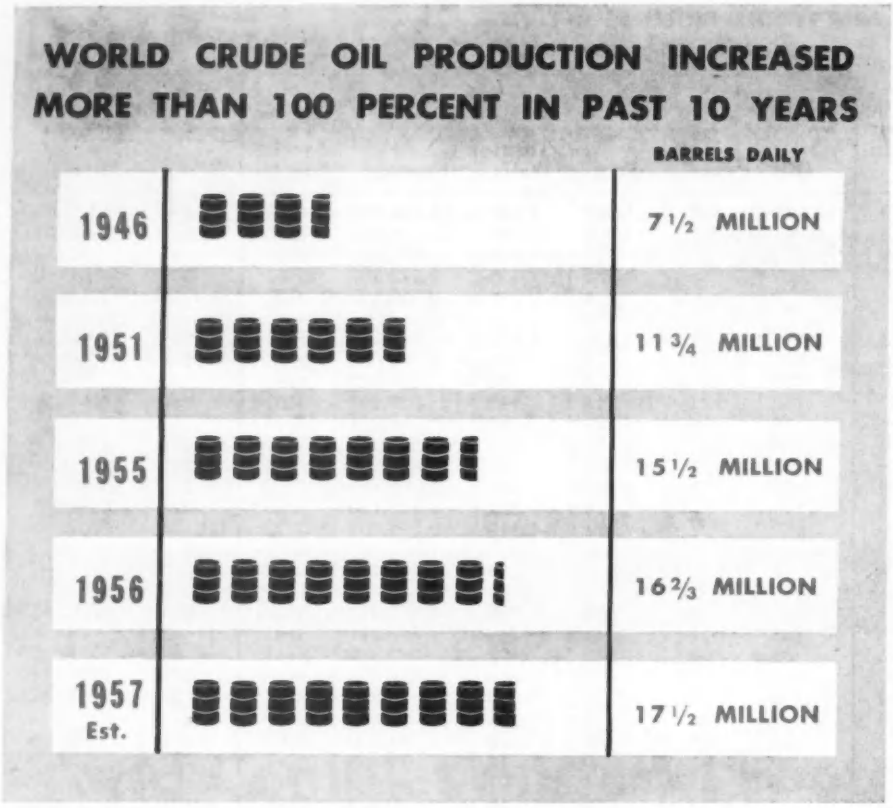
* Includes one observation well and 2 water-injection wells.

amounted to 235,386,441 feet, the total footage drilled in North America amounted to 18,221,316 feet and resulted in an average depth per well of 4290 feet for each of the 4247 wells completed during the year.

The U. S. accounted for 58,418 wells with an average depth per well of 4029 feet.

In South America last year, 2636 completions resulted in a footage drilled figure of 15,040,039 feet, which was tantamount to an average depth per well of 5706 feet.

On the basis of average depth per well, Africa easily gained the No. 1 position. There, 154 completions last year, along with a footage drilled total of 1,499,566 feet, accounted for an average depth of 9737 feet, also easily outstripping Western Europe, the Middle East and Far East, and Oceania. In the latter three categories—Far East and Oceania are combined—average depth per well was 4860 feet, 5961 feet, and 4314 feet, respectively.



World Crude Production . . .

South America records major gain.

WORLD CRUDE production reached another new height during 1956, with South America furnishing the impetus. Thanks to that area's 13.9 percent increase in output, total world 1956 crude production rose almost 8.2 percent—or 459,940,000 barrels—from the previous year for a record 6,102,116,000 barrels.

Daily production averaged almost 16.7 million barrels last year—1.2 million barrels daily more than was produced in 1955.

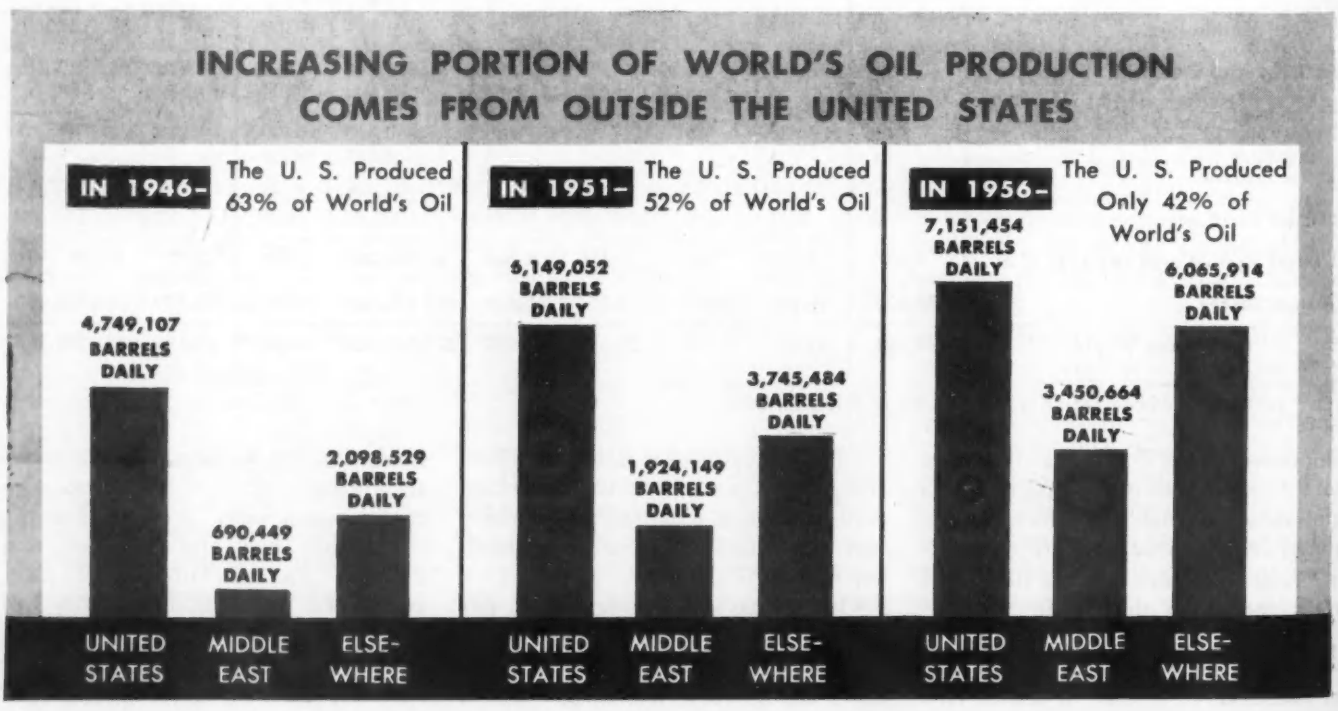
Last year's new producing record increased the world's cumulative production total (through 1956) to almost 95.9 billion barrels.

Gains Reported. Among the Free World's leading crude producing regions, South America, the third largest producer, recorded the sharpest production gain—13.9 percent, or 338,456 barrels a day more than production during the previous year. The region's average daily yield amounted to 2,832,064 barrels for an annual production of 1,036,535,000 barrels. That was tantamount to 16.99 percent of the world total.

South America had accounted for 16.13 percent of the world total in 1955 and 16.9 percent in 1950.

Although the Far East produced last year a total of only 168,801,000 barrels, which placed it in the fifth ranking position in the production category, the region recorded by a bare margin the second highest percentage increase from 1955. Daily average production of 461,205 barrels amounted to 2.76 percent of the world's total for the year.

The second largest producing region, the Middle East, recorded the third largest production gain with a 7 percent (217,306 barrels per day) increase from 1955. Annual production amounted to 1,262,943,000 barrels for a daily average of 3,450,664



barrels, 20.70 percent of total world supply.

While dropping from third to fourth position last year in the percentage gained category, North America continued to lead all other producing regions of the world in crude production volume with a daily average of 7,872,656 barrels.

WORLD CRUDE OIL PRODUCTION, BY COUNTRIES, 1955 AND 1956, CUMULATIVE THROUGH 1956

(Sources: Annual data from private sources or estimates by WORLD OIL. Cumulative totals based on U. S. Bureau of Mines 1954 data.)

CONTINENT and COUNTRY	Annual Production (Thousands of Barrels)		Daily Average Production (Actual Barrels)			Year's Production As Percent of World		Cumulative Production To January 1, 1957 (Thousands of Barrels)	
	1955	1956	1955	1956	% Diff. '55-'56	1955	1956	Total	As % of World
North America	**2,702,483**	**2,881,392**	**7,407,368**	**7,872,656**	**+ 6.6**	**47.89**	**47.21**	**58,985,411**	**61.52**
Canada	129,452	169,321	354,663	462,626	+ 30.8	2.29	2.77	776,083	0.81
Cuba	382	543	1,046	1,484	+ 42.1	0.01	0.01	3,412	.....
Mexico	88,128	94,096	241,447	257,093	+ 6.8	1.56	1.54	2,975,258	3.10
United States	2,484,521	2,617,432	6,806,842	7,151,454	+ 5.3	44.03	42.89	55,230,658	57.61
South America	**910,167**	**1,036,535**	**2,493,608**	**2,832,064**	**+ 13.9**	**16.13**	**16.99**	**12,391,757**	**12.92**
Argentina	30,457	31,717	83,443	86,659	+ 3.6	0.54	0.52	627,785	0.65
Barbados	.....	.....	.....	.....	.....	.....	.....	8	.....
Bolivia	2,692	3,196	7,376	8,732	+ 17.7	0.04	0.06	14,820	0.02
Brazil	2,021	4,059	5,536	11,090	+100.8	0.04	0.06	10,408	0.01
Chile	2,577	3,542	7,060	9,678	+ 37.4	0.04	0.06	11,413	0.01
Colombia	39,363	44,132	107,843	120,579	+ 12.1	0.70	0.72	746,317	0.78
Ecuador	3,531	3,394	9,674	9,273	— 3.9	0.07	0.06	67,615	0.07
Peru	17,246	18,383	47,249	50,227	+ 6.6	0.30	0.30	502,791	0.52
Trinidad	24,896	28,929	68,207	79,041	+ 16.2	0.44	0.48	554,998	0.58
Venezuela	787,384	899,183	2,157,196	2,456,785	+ 14.2	13.96	14.73	9,855,834	10.28
Europe	**677,717**	**739,178**	**1,854,019**	**2,019,612**	**+ 9.0**	**12.02**	**12.12**	**11,595,813**	**12.09**
Albania	1,871	2,441	5,126	6,669	+ 30.5	0.03	0.04	27,774	0.03
Austria	24,852	23,268	68,087	63,574	— 6.4	0.44	0.38	195,761	0.21
Bulgaria	1,000	1,600	2,732	4,371	+ 60.0	0.01	0.02	3,136	.....
Czechoslovakia	1,117	1,201	3,060	3,281	+ 7.5	0.02	0.02	10,427	0.01
France	6,409	9,103	17,559	24,871	+ 42.0	0.11	0.15	41,408	0.04
Germany	22,345	24,894	61,219	68,016	+ 11.4	0.40	0.41	210,722	0.22
Great Britain	394	489	1,079	1,338	+ 24.1	0.01	0.01	7,295	0.01
Hungary	12,208	7,630	33,446	20,847	— 37.5	0.22	0.13	89,102	0.09
Italy and Sicily	2,536	4,822	6,948	13,175	+ 30.1	0.05	0.08	12,725	0.01
Netherlands	7,137	7,652	19,553	20,906	+ 7.2	0.13	0.13	51,563	0.06
Poland	2,864	1,363	7,846	3,724	— 50.4	0.05	0.02	291,047	0.30
Rumania	78,815	81,387	215,931	222,369	+ 3.3	1.40	1.33	1,613,788	1.69
U.S.S.R. (Russia)	514,433	571,208	1,409,392	1,560,678	+ 11.0	9.12	9.36	9,029,789	9.41
Yugoslavia	1,736	2,120	4,756	5,790	+ 22.1	0.03	0.04	11,276	0.01
Africa	**13,932**	**13,249**	**38,170**	**36,199**	**— 4.9**	**0.25**	**0.22**	**248,748**	**0.26**
Algeria	434	293	1,189	653	— 32.5	0.01	0.01	2,513	.....
Egypt	12,740	12,174	34,904	33,263	— 4.4	0.23	0.20	240,839	0.25
Morocco	758	720	2,077	1,967	— 5.0	0.01	0.01	5,334	0.01
Angola	.....	62	.....	169	.....	.....	.....	62	.....
Asia, Total	**1,337,854**	**1,431,744**	**3,665,286**	**3,911,869**	**+ 7.0**	**23.71**	**23.46**	**12,649,532**	**13.21**
Asia, Middle East	**1,180,199**	**1,262,943**	**3,233,358**	**3,450,664**	**+ 7.0**	**20.92**	**20.70**	**9,802,958**	**10.24**
Bahrain	10,982	11,014	30,087	30,093	+ 0.3	0.19	0.18	186,880	0.20
Iran	120,137	198,289	329,139	541,774	+ 65.1	2.13	3.25	2,866,491	2.99
Iraq	246,479	233,421	675,285	637,762	— 5.3	4.37	3.83	1,616,741	1.69
Kuwait	398,494	399,874	1,091,763	1,092,552	+ 0.3	7.07	6.55	2,223,000	2.32
Neutral Zone	8,848	11,725	24,241	32,036	+ 32.5	0.15	0.19	26,568	0.03
Qatar	41,808	45,345	114,541	123,594	+ 8.5	0.74	0.75	210,910	0.22
Saudi Arabia	352,240	360,923	965,032	986,129	+ 2.5	6.25	5.91	2,667,732	2.78
Turkey	1,199	2,200	3,285	6,011	+ 83.5	0.02	0.04	4,472	0.01
Israel	12	152	33	415	+1166.7	.....	.....	164	.....
Asia, Far East	**157,655**	**168,801**	**431,928**	**461,205**	**+ 7.1**	**2.79**	**2.76**	**2,846,574**	**2.97**
Burma	1,618	1,680	4,433	4,590	+ 3.8	0.03	0.03		
India	2,526	2,876	6,921	7,858	+ 13.9	0.04	0.04	375,159	0.39
Pakistan	2,068	2,114	5,666	5,776	+ 2.2	0.04	0.04		
China	13,200	11,000	36,164	30,055	— 16.7	0.23	0.18	35,427	0.03
Indonesia	85,921	93,820	235,398	256,339	+ 9.2	1.53	1.54	1,718,937	1.80
Japan	2,229	2,169	6,107	5,926	— 2.7	0.04	0.03	111,539	0.12
New Guinea	3,418	2,618	9,364	7,154	— 23.7	0.06	0.04	18,912	0.02
Sakhalin	7,300	7,000	20,000	19,126	— 4.1	0.13	0.12	137,540	0.14
Sarawak-Brunei (Br. Borneo)	39,351	45,503	107,810	116,127	+ 8.0	0.69	0.74	448,616	0.47
Taiwan (Formosa)	24	21	66	57	— 12.5	.....	.....	444	.....
Australia-New Zealand	**23**	**18**	**63**	**49**	**— 21.7**	.....	.....	**131**	.....
World, Undistributed	.....	.....	.....	.....	.....	.....	.....	1,044	.....
TOTAL, WORLD	**5,642,176**	**6,102,116**	**15,458,016**	**16,672,448**	**+ 8.15**	**100.0**	**100.0**	**95,872,436**	**100.0**

World Crude Oil Production, By Countries, By Years (Part 1)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

World and North America, 1857-1895

YEAR	World Total	Percent Produced by U. S.	Canada	United States	Total North America
1856	....	....	....	....	....
1857	2	....	....	....	....
1858	4	....	....	....	....
1859	6	31	....	2	2
1860	500	98	....	500	500
1861	2,131	99	....	2,114	2,114
1862	3,092	99	12	3,057	3,069
1863	2,763	94	83	2,611	2,694
1864	2,304	92	90	2,116	2,206
1865	2,716	92	110	2,498	2,608
1866	3,899	92	175	3,598	3,773
1867	3,709	90	190	3,347	3,537
1868	3,990	91	200	3,646	3,846
1869	4,696	90	220	4,215	4,435
1870	5,799	91	250	5,261	5,511
1871	5,730	91	270	5,205	5,475
1872	6,877	92	308	6,293	6,601
1873	10,838	91	365	9,894	10,259
1874	11,933	92	169	10,927	11,096
1875	9,977	88	220	8,788	9,008
1876	11,051	83	312	9,133	9,445
1877	15,754	85	312	13,350	13,662
1878	18,417	84	312	15,397	15,709
1879	23,601	84	575	19,914	20,489
1880	30,018	88	350	26,286	26,636
1881	31,993	86	275	27,661	27,936
1882	35,704	85	275	30,350	30,625
1883	30,255	78	250	23,450	23,700
1884	35,969	67	250	24,218	24,468
1885	36,765	59	250	21,859	22,109
1886	47,243	59	584	28,065	28,649
1887	47,807	59	526	28,283	28,809
1888	52,165	53	695	27,612	28,307
1889	61,507	57	705	35,164	35,869
1890	76,633	60	795	45,824	46,619
1891	91,100	60	755	54,293	55,048
1892	88,739	57	780	50,515	51,295
1893	92,038	53	798	48,431	49,229
1894	89,337	55	829	49,344	50,173
1895	103,692	51	726	52,892	53,618

World and North America, 1896 to Now

South America, Since Beginning in 1896

YEAR	WORLD TOTAL	Percent Produced by U.S.	NORTH AMERICA					Argentina	Barbados	Bolivia	Brasil	Chile	Colombia	Ecuador	Peru	Trinidad	Venezuela	Total South America
			Canada	Mexico	United States	Cuba	Total North America											
1896	114,199	53	727	.....	60,960	.....	61,687	.....	.....	.....	.....	.....	.....	.....	47	.....	.....	47
1897	121,993	50	710	.....	60,476	.....	61,186	.....	.....	.....	.....	.....	.....	.....	71	.....	.....	71
1898	124,979	44	758	.....	55,364	.....	56,122	.....	.....	.....	.....	.....	.....	.....	71	.....	.....	71
1899	131,147	44	808	.....	57,071	.....	57,879	.....	.....	.....	.....	.....	.....	.....	89	.....	.....	89
1900	149,137	43	913	.....	63,621	.....	64,534	.....	.....	.....	.....	.....	.....	.....	274	.....	.....	274
1901	167,440	41	757	10	69,389	.....	70,156	.....	.....	.....	.....	.....	.....	.....	275	.....	.....	275
1902	181,809	40	531	40	88,767	.....	89,338	.....	.....	.....	.....	.....	.....	.....	287	.....	.....	287
1903	194,879	52	487	75	100,461	.....	101,023	.....	.....	.....	.....	.....	.....	.....	278	.....	.....	278
1904	217,948	54	553	126	117,081	.....	117,760	.....	.....	.....	.....	.....	.....	.....	290	.....	.....	290
1905	215,091	63	634	251	134,717	.....	135,602	.....	.....	.....	.....	.....	.....	.....	373	.....	.....	373
1906	213,263	59	569	502	126,494	.....	127,565	.....	.....	.....	.....	.....	.....	.....	531	.....	.....	531
1907	263,957	63	789	1,005	166,095	.....	167,889	B	.....	.....	.....	.....	.....	.....	751	.....	.....	751
1908	285,287	63	528	3,933	178,527	.....	182,988	12	.....	.....	.....	.....	.....	.....	945	B	.....	957
1909	298,709	61	421	2,714	183,171	.....	186,306	18	.....	.....	.....	.....	.....	.....	1,411	57	.....	1,486
1910	327,763	64	316	3,634	209,557	.....	213,507	20	.....	.....	.....	.....	.....	.....	1,258	143	.....	1,421
1911	344,361	64	291	12,553	220,449	.....	233,293	13	.....	.....	.....	.....	.....	.....	1,465	295	.....	1,763
1912	352,443	63	243	16,558	222,935	.....	239,736	47	.....	.....	.....	.....	.....	.....	1,752	437	.....	2,236
1913	385,345	64	228	25,696	248,446	.....	274,370	131	.....	.....	.....	.....	.....	.....	2,071	504	.....	2,706
1914	407,544	65	215	26,235	265,763	.....	292,213	276	.....	.....	.....	.....	.....	.....	1,837	644	.....	2,757
1915	432,033	65	215	32,911	281,104	.....	314,230	513	.....	.....	.....	.....	.....	.....	2,579	750	.....	3,842
1916	457,500	66	198	40,546	300,767	.....	341,511	867	.....	.....	.....	.....	.....	.....	2,593	929	.....	4,389
1917	502,891	67	214	55,293	335,316	.....	390,823	1,218	.....	.....	.....	.....	.....	57	2,577	1,602	120	5,574
1918	503,515	71	305	63,828	355,928	.....	420,061	1,353	.....	.....	.....	.....	.....	C60	2,527	2,082	333	6,355
1919	555,875	68	241	87,073	378,367	.....	465,681	1,331	.....	.....	.....	.....	.....	C60	2,628	1,841	425	6,285
1920	688,884	64	196	157,069	442,929	.....	600,194	1,651	.....	.....	.....	.....	.....	C60	2,817	2,083	457	7,068
1921	766,002	62	188	193,398	472,183	.....	665,769	2,036	.....	.....	.....	.....	67	C60	3,699	2,351	1,433	9,649
1922	858,898	65	179	182,278	557,531	.....	739,988	2,866	.....	.....	.....	.....	323	C60	5,314	2,445	2,201	13,209
1923	1,015,736	72	170	149,585	732,407	.....	882,162	3,400	.....	.....	.....	.....	425	87	5,699	3,051	4,201	16,863
1924	1,014,318	70	161	139,678	713,940	.....	853,779	4,639	.....	.....	.....	.....	445	C100	8,379	4,057	9,042	26,662
1925	1,068,933	71	332	115,515	763,743	.....	879,590	6,336	.....	.....	.....	.....	1,007	160	9,232	4,387	19,687	40,809
1926	1,096,823	70	364	90,421	770,874	.....	861,659	7,851	.....	.....	.....	.....	6,444	214	10,762	4,971	36,911	67,153
1927	1,262,582	71	477	64,121	901,129	.....	965,727	8,630	.....	.....	.....	.....	15,014	537	10,127	5,380	63,134	102,822
1928	1,324,774	68	624	50,151	901,474	.....	952,249	9,070	.....	.....	.....	.....	19,897	1,084	12,006	7,684	105,749	155,490
1929	1,485,867	68	1,117	44,688	1,007,323	.....	1,053,128	9,391	.....	B	.....	.....	20,385	1,381	13,422	8,716	137,472	190,767
1930	1,410,037	64	1,522	39,530	898,011	.....	939,063	9,002	.....	56	.....	.....	20,346	1,553	12,449	9,419	136,669	189,494
1931	1,372,532	62	1,543	33,039	851,081	.....	885,663	11,709	.....	25	.....	.....	18,237	1,762	10,089	9,744	116,613	168,179
1932	1,309,677	60	1,044	32,805	785,159	.....	819,008	13,139	.....	44	.....	.....	16,414	1,597	9,899	10,126	116,541	167,760
1933	1,442,146	63	1,145	34,001	905,656	23	940,825	13,691	.....	112	.....	.....	13,158	1,620	13,257	9,561	117,720	169,119
1934	1,522,288	60	1,417	38,172	908,065	28	947,682	14,024	.....	159	.....	.....	17,341	1,637	16,314	10,894	136,103	196,472
1935	1,654,495	60	1,447	40,241	996,596	47	1,038,331	14,297	.....	164	.....	.....	17,598	1,732	17,067	11,871	148,254	210,783
1936	1,791,546	61	1,500	41,028	1,099,687	62	1,142,277	15,458	.....	105	.....	.....	18,756	1,942	17,593	13,237	154,794	221,885
1937	2,039,231	63	2,944	46,907	1,279,160	33	1,329,044	16,355	.....	122	.....	.....	20,599	2,161	17,457	15,503	186,230	258,427
1938	1,988,041	61	6,966	38,506	1,214,355	78	1,259,905	17,076	.....	226	.....	.....	21,582	2,246	15,839	17,737	188,174	262,880
1939	2,086,160	60.6	7,838	42,898	1,264,962	112	1,315,810	18,613	.....	215	.....	.....	23,857	2,313	13,508	19,270	206,470	284,246
1940	2,149,821	62.9	8,591	44,036	1,353,214	142	1,405,983	20,609	.....	288	2	.....	25,593	2,349	12,126	22,227	185,570	268,764
1941	2,220,657	63.1	10,134	42,196	1,402,228	150	1,454,708	21,873	.....	235	3	.....	24,553	1,557	11,935	20,506	228,430	309,092
1942	2,093,100	66.2	10,365	34,815	1,386,645	151	1,431,976	23,704	2	308	33	.....	10,487	2,278	13,629	22,069	147,675	220,185
1943	2,256,637	66.7	10,052	35,163	1,505,613	107	1,550,935	27,714	2	334	48	.....	13,261	2,315	14,654	21,385	177,631	257,344
1944	2,592,289	64.7	10,099	38,203	1,677,904	109	1,726,315	24,230	1	314	58	.....	22,291	2,967	14,389	22,139	257,046	343,435
1945	2,594,697	66.0	8,483	43,547	1,713,655	149	1,765,834	22,881	2	382	79	.....	22,449	2,664	13,744	21,093	323,156	406,450
1946	2,745,430	63.2	7,586	49,235	1,733,939	269	1,791,029	20,604	1	363	67	.....	22,118	2,323	12,468	20,233	388,486	466,663
1947	3,022,139	61.4	7,692	56,284	1,856,987	300	1,921,263	21,846	B	377	97	.....	24,794	2,282	12,764	20,521	434,905	517,586
1948	3,433,225	58.8	12,287	58,508	2,020,185	159	2,091,139	23,734	.....	464	144	.....	23,792	2,565	14,069	20,111	490,015	574,892
1949	3,404,132	54.1	21,305	60,910	1,841,940	206	1,924,361	22,589	.....	678	109	.....	29,722	2,617	14,796	20,617	482,316	573,444
1950	3,802,995	51.9	29,044	72,443	1,973,574	156	2,075,217	23,353	.....	616	339	629	34,060	2,632	15,012	20,632	546,783	644,056
1951	4,282,730	52.5	47,615	77,312	2,247,711	128	2,372,766	24,465	.....	523	691	760	38,398	2,708	16,110	20,843	622,216	726,714
1952	4,504,708	50.8	61,237	77,275	2,289,836	36	2,428,384	24,588	.....	526	750	910	38,683	2,839	16,403	21,258	660,254	766,211
1953	4,786,989	49.2	80,899	72,440	2,357,082	17	2,510,438	28,501	.....	601	916	1,258	40,179	2,967	15,999	22,346	644,243	757,010
1954	5,006,205	46.2	96,080	83,653	2,314,988	25	2,494,746	29,650	.....	1,695	992	1,736	40,547	3,146	17,161	23,629	691,908	810,364
1955‡	5,641,176	44.0	129,452	88,128	2,484,521	382	2,702,483	30,457	.....	2,692	2,021	2,577	39,363	3,531	17,246	24,896	787,384	910,167
1956‡	6,100,516	42.9	169,321	94,096	2,617,432	543	2,881,392	31,717	.....	3,196	4,059	3,542	44,132	3,394	18,383	28,929	899,183	1,036,535
Total	95,8[illegible]436	.....	776,083	2,975,258	55,230,658	3,412	58,985,411	627,785	8	14,820	10,408	11,413	746,317	67,615	502,791	554,998	9,855,834	12,391,757

B Less than 1,000 barrels. C Estimated production. ‡ WORLD OIL from private sources.

World Crude Oil Production, By Countries, By Years (Part 2)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

Asia, Total, and Asia, Far East, Since Beginning in 1875

YEAR	[F]Total Asia	ASIA — Far East										
		[E]Burma-India Pakistan										
		Burma	Pakistan	India	China	Indonesia	Japan	New Guinea	Sakhalin	Sarawak Brunei	Formosa	Total Far East
1874	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1875	5	.....	.....	.....	.....	.....	5	.....	.....	.....	.....	5
1876	7	.....	.....	.....	.....	.....	7	.....	.....	.....	.....	7
1877	10	.....	.....	.....	.....	.....	10	.....	.....	.....	.....	10
1878	18	.....	.....	.....	.....	.....	18	.....	.....	.....	.....	18
1879	23	.....	.....	.....	.....	.....	23	.....	.....	.....	.....	23
1880	26	.....	.....	.....	.....	.....	26	.....	.....	.....	.....	26
1881	17	.....	.....	.....	.....	.....	17	.....	.....	.....	.....	17
1882	15	.....	.....	.....	.....	.....	15	.....	.....	.....	.....	15
1883	20	.....	.....	.....	.....	.....	20	.....	.....	.....	.....	20
1884	28	.....	.....	.....	.....	.....	28	.....	.....	.....	.....	28
1885	30	.....	.....	.....	.....	.....	30	.....	.....	.....	.....	30
1886	38	.....	.....	.....	.....	.....	38	.....	.....	.....	.....	38
1887	29	.....	.....	.....	.....	.....	29	.....	.....	.....	.....	29
1888	37	.....	.....	.....	.....	.....	37	.....	.....	.....	.....	37
1889	147	.....	94	.....	.....	.....	53	.....	.....	.....	.....	147
1890	170	.....	118	.....	.....	.....	52	.....	.....	.....	.....	170
1891	243	.....	190	.....	.....	.....	53	.....	.....	.....	.....	243
1892	311	.....	242	.....	.....	.....	69	.....	.....	.....	.....	311
1893	1,005	.....	299	.....	.....	600	106	.....	.....	.....	.....	1,005
1894	1,188	.....	327	.....	.....	688	173	.....	.....	.....	.....	1,188
1895	1,758	.....	372	.....	.....	1,216	170	.....	.....	.....	.....	1,758
1896	2,094	.....	430	.....	.....	1,427	237	.....	.....	.....	.....	2,094
1897	3,360	.....	546	.....	.....	2,552	262	.....	.....	.....	.....	3,360
1898	3,825	.....	542	.....	.....	2,964	319	.....	.....	.....	.....	3,825
1899	3,276	.....	941	.....	.....	1,796	539	.....	.....	.....	.....	3,276
1900	4,203	.....	1,079	.....	.....	2,253	871	.....	.....	.....	.....	4,203
1901	6,562	.....	1,431	.....	.....	4,014	1,117	.....	.....	.....	.....	6,562
1902	5,043	.....	1,617	.....	.....	2,430	996	.....	.....	.....	.....	5,043
1903	9,489	.....	2,510	.....	.....	5,770	1,209	.....	.....	.....	.....	9,489
1904	11,112	.....	3,385	.....	.....	6,508	1,219	.....	.....	.....	.....	11,112
1905	13,334	.....	4,137	.....	.....	7,850	1,347	.....	.....	.....	.....	13,334
1906	13,761	.....	4,016	.....	.....	8,181	1,564	.....	.....	.....	.....	13,761
1907	16,045	.....	4,344	.....	.....	9,983	1,718	.....	.....	.....	.....	16,045
1908	17,201	.....	5,047	.....	.....	10,283	1,871	.....	.....	.....	.....	17,201
1909	19,606	.....	6,677	.....	.....	11,042	1,887	.....	.....	.....	.....	19,606
1910	18,998	.....	6,138	.....	.....	11,031	1,829	.....	.....	.....	.....	18,998
1911	20,361	.....	6,451	.....	.....	12,173	1,737	.....	.....	.....	.....	20,361
1912	19,622	.....	7,117	.....	.....	10,846	1,659	.....	.....	.....	.....	19,622
1913	23,040	.....	7,930	.....	.....	11,172	1,940	.....	.....	141	.....	21,183
1914	24,696	.....	7,410	.....	.....	11,422	2,636	.....	.....	318	.....	21,786
1915	27,058	.....	8,202	.....	.....	11,920	2,928	.....	.....	392	.....	23,442
1916	29,107	.....	8,491	.....	.....	12,547	2,963	.....	.....	629	.....	24,630
1917	31,809	.....	8,079	.....	.....	13,180	2,861	.....	.....	542	.....	24,662
1918	32,534	.....	8,188	.....	.....	12,778	2,441	.....	.....	504	.....	23,911
1919	37,217	.....	8,736	.....	.....	15,508	2,238	.....	.....	596	.....	27,078
1920	41,375	.....	8,375	.....	.....	17,529	2,221	.....	.....	1,020	.....	29,145
1921	46,011	.....	8,734	.....	.....	16,958	2,233	.....	2	1,411	.....	29,338
1922	52,753	.....	8,529	.....	.....	17,066	2,055	.....	7	2,849	.....	30,506
1923	59,259	.....	8,406	.....	.....	19,870	1,804	.....	9	3,940	.....	34,029
1924	67,319	.....	8,416	.....	.....	20,473	1,814	.....	80	4,163	.....	34,946
1925	70,993	.....	8,274	.....	.....	21,422	1,915	.....	87	4,257	.....	35,955
1926	72,004	.....	8,011	.....	.....	21,243	1,785	.....	181	4,942	.....	36,162
1927	82,689	.....	8,032	.....	.....	27,459	1,789	.....	440	4,943	.....	42,663
1928	92,877	.....	8,741	.....	.....	32,118	1,944	.....	677	[G]5,223	.....	48,703
1929	99,416	.....	8,747	.....	.....	39,279	2,023	.....	[D]1,134	5,290	.....	56,473
1930	105,424	.....	8,292	.....	.....	41,729	1,950	.....	[D]1,805	4,907	.....	58,683
1931	97,583	.....	8,200	.....	.....	35,539	2,050	.....	2,734	3,854	.....	52,377
1932	106,182	.....	8,817	.....	.....	39,001	1,630	.....	2,631	3,796	.....	55,875
1933	114,972	.....	8,743	.....	.....	42,606	1,455	.....	2,338	4,490	.....	59,632
1934	133,108	.....	10,503	.....	.....	46,925	1,834	.....	2,881	5,140	.....	67,283
1935	152,676	7,181	[E]	2,038	.....	47,171	2,249	.....	2,545	5,546	.....	66,730
1936	168,241	7,588	[E]	1,978	.....	50,025	2,440	.....	3,212	5,209	.....	70,452
1937	196,354	7,848	[E]	2,162	.....	56,724	2,488	.....	3,656	6,009	.....	78,887
1938	200,397	7,538	[E]	2,488	.....	57,318	2,511	.....	[C]3,821	6,913	.....	80,589
1939	206,507	7,873	[E]	2,327	4	62,087	2,654	.....	4,000	7,097	.....	86,042
1940	188,431	7,731	[E]	2,302	10	62,011	2,639	.....	4,000	7,047	.....	85,740
1941	151,838	7,762	[E]	2,899	87	53,704	1,929	.....	4,000	6,864	62	77,307
1942	141,085	2,500	[E]	2,792	340	24,000	1,652	.....	4,000	3,000	48	38,332
1943	174,641	1,000	[E]	2,735	447	48,294	1,727	.....	5,000	4,500	38	63,741
1944	186,436	750	[E]	2,784	505	22,260	1,601	.....	5,000	6,000	40	38,940
1945	215,088	725	[E]	2,363	484	7,600	1,544	.....	6,000	2,100	14	20,830
1946	270,599	15	[E]	2,193	513	2,100	1,343	.....	6,000	2,050	16	14,230
1947	338,260	59	356	1,863	374	8,020	1,276	.....	[C]7,000	12,970	22	31,940
1948	480,188	341	490	1,875	533	31,765	1,122	135	7,000	20,124	23	63,408
1949	593,737	248	931	1,906	730	43,206	1,353	1,726	7,000	25,108	22	82,230
1950	735,519	532	1,281	1,867	800	48,400	2,048	1,748	7,000	30,958	23	94,657
1951	809,754	851	1,348	1,949	900	55,453	2,337	1,746	7,000	37,506	21	109,111
1952	877,571	869	1,580	1,900	1,000	62,495	2,134	1,725	7,000	38,251	18	116,972
1953	1,014,607	1,051	1,762	2,215	1,500	75,626	2,101	1,751	7,000	36,848	17	129,871
1954	1,137,562	1,345	1,945	2,235	3,000	79,586	2,124	4,045	8,000	36,315	35	138,630
1955*	1,337,854	1,618	2,068	2,526	13,200	85,921	2,229	3,418	7,300	39,351	24	157,655
1956*	1,431,744	1,680	2,114	2,876	11,000	93,820	2,169	2,618	7,000	45,503	21	168,801
Total	12,649,532	375,159			35,427	1,718,937	111,539	18,912	137,540	448,616	444	2,846,574

Asia, Middle East, Newer Fields, 1946 to Now

YEAR	Israel	Kuwait	Neutral Zone	Qatar	Turkey	Total Newer Fields
1941	.....	.....	.....	.....	.....	.....
1942	.....	.....	.....	.....	.....	.....
1943	.....	.....	.....	.....	.....	.....
1944	.....	.....	.....	.....	.....	.....
1945	.....	.....	.....	.....	.....	.....
1946	.....	5,931	.....	.....	.....	5,931
1947	.....	16,225	.....	.....	.....	16,225
1948	.....	46,500	.....	.....	13	46,513
1949	.....	90,000	.....	750	95	90,845
1950	.....	125,722	.....	12,268	108	138,098
1951	.....	204,910	.....	18,009	133	223,052
1952	.....	273,433	.....	25,255	146	298,834
1953	.....	314,592	.....	31,025	179	345,796
1954	.....	347,319	5,995	36,450	399	390,163
1955	12	398,494	8,848	41,908	1,199	450,361
1956	152	399,874	11,725	45,345	2,200	459,296
Total	164	2,223,000	26,568	210,910	4,472	2,465,114

Asia, Middle East, Total and Asia, Middle East, Older Fields, 1913 to Now

YEAR	Middle East Total	MIDDLE EAST OLDER FIELDS				
		Bahrein	Iran	Iraq	Saudi Arabia	Total Older Fields
1911	.....	.....	.....	.....	.....	.....
1912	.....	.....	.....	.....	.....	.....
1913	1,857	.....	1,857	.....	.....	1,857
1914	2,910	.....	2,910	.....	.....	2,910
1915	3,616	.....	3,616	.....	.....	3,616
1916	4,477	.....	4,477	.....	.....	4,477
1917	7,147	.....	7,147	.....	.....	7,147
1918	8,623	.....	8,623	.....	.....	8,623
1919	10,139	.....	10,139	.....	.....	10,139
1920	12,230	.....	12,230	.....	.....	12,230
1921	16,673	.....	16,673	.....	.....	16,673
1922	22,247	.....	22,247	.....	.....	22,247
1923	25,230	.....	25,230	.....	.....	25,230
1924	32,373	.....	32,373	.....	.....	32,373
1925	35,038	.....	35,038	.....	.....	35,038
1926	35,842	.....	35,842	.....	.....	35,842
1927	40,026	.....	39,688	338	.....	40,026
1928	44,174	.....	43,461	713	.....	44,174
1929	42,943	.....	42,145	798	.....	42,943
1930	46,741	.....	45,828	913	.....	46,741
1931	45,206	.....	44,376	830	.....	45,206
1932	50,307	.....	49,471	836	.....	50,307
1933	55,340	31	54,392	917	.....	55,340
1934	65,825	285	57,851	7,689	.....	65,825
1935	85,946	1,265	57,273	27,408	.....	85,946
1936	97,789	4,645	62,718	30,406	20	97,789
1937	117,467	7,762	77,804	31,836	65	117,467
1938	119,808	8,298	78,372	32,643	495	119,808
1939	120,465	7,589	78,151	30,791	3,934	120,465
1940	102,691	7,074	66,317	24,225	5,075	102,691
1941	74,531	6,794	50,777	12,650	4,310	74,531
1942	102,753	6,241	72,256	19,726	4,530	102,753
1943	110,900	6,572	74,612	24,848	4,868	110,900
1944	147,496	6,714	102,045	30,943	7,794	147,496
1945	194,258	7,309	130,526	35,112	21,311	194,258
1946	256,369	8,010	146,819	35,665	59,944	250,438
1947	306,320	9,411	154,998	35,834	89,852	290,095
1948	416,780	10,915	190,384	26,115	142,853	370,267
1949	511,507	10,985	204,712	30,957	174,008	420,662
1950	640,862	11,016	242,475	49,726	199,547	502,764
1951	700,643	10,994	123,512	65,122	277,963	477,591
1952	760,599	11,004	7,800	141,100	301,861	461,765
1953	884,736	10,978	9,400	210,268	308,294	538,940
1954	998,932	10,992	21,500	228,432	347,845	608,769
1955	1,180,199	10,982	120,137	246,479	352,240	729,838
1956	1,262,94[3]	11,014	198,289	233,421	360,923	803,647
Total	9,802,958	186,880	2,866,491	1,616,741	2,667,732	7,337,844

[B] Less than 1,000 barrels. [C] Estimated production [D] Year ended September 30. [E] Separation of British India and Burma prior to 1935 not available from U.S. Bureau of Mines data used here. Data by Dudley Stamp in "Petroleum Development and Technology, 1933" and in A.I.M.E. "Transactions" indicate cumulative through 1934 as follows: Burma 184,528, India 20,756. Pakistan included with India prior to 1947. [F] Exclusive of U.S.S.R. fields in Asia, other than Sakhalin, which are included with U.S.S.R in Europe. [G] Beginning of production in Brunei. [H] Formosa included with Japan prior to 1941. * WORLD OIL from private sources.

World Crude Oil Production, By Countries, By Years (Part 3)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

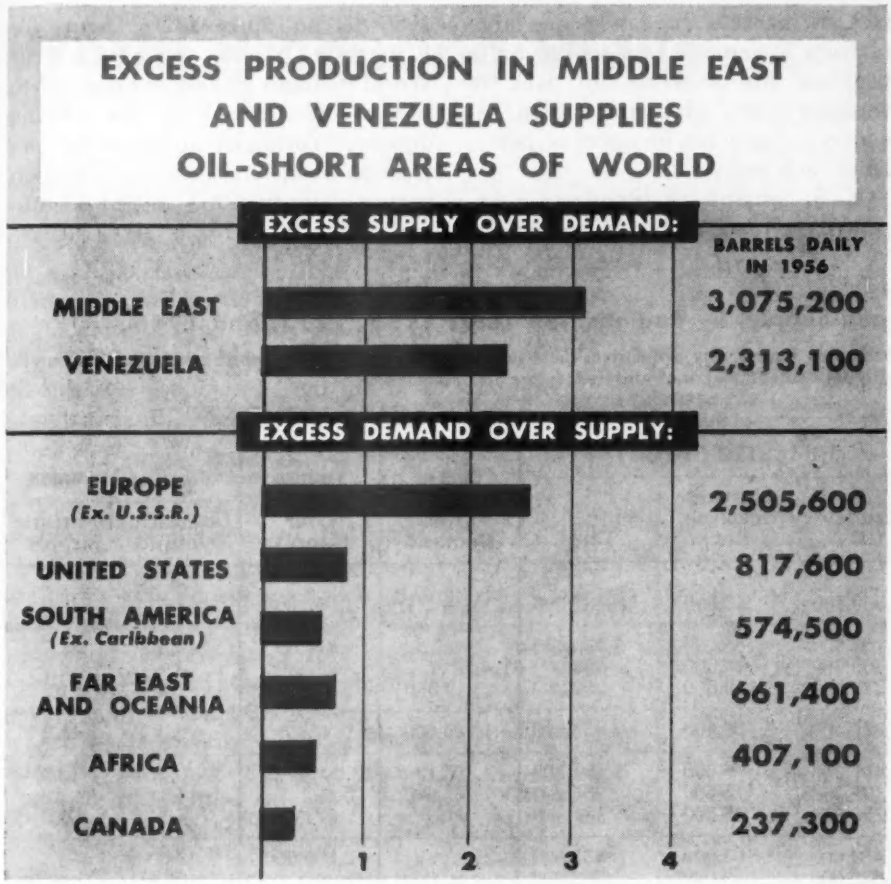
Europe, 1857-1900

YEAR	Italy	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe	YEAR	Germany	Italy	Poland	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe	YEAR	Germany	Italy	Poland	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe
1856	....	....	....	....	1871	....	[B]	....	90	165	255	1886	74	2	306	168	18,006	18,556
1857	....	2	....	2	1872	....	[B]	....	91	185	276	1887	74	1	344	182	18,368	18,969
1858	....	4	....	4	1873	....	[B]	....	104	475	579	1888	85	1	467	219	23,049	23,821
1859	....	4	....	4	1874	....	1	150	103	583	837	1889	68	1	515	298	24,609	25,491
1860	....	9	....	9	1875	....	1	158	108	697	964	1890	108	3	659	383	28,691	29,844
1861	[B]	17	....	17	1876	....	3	164	111	1,321	1,599	1891	109	8	631	488	34,573	35,809
1862	[B]	23	....	23	1877	....	3	170	108	1,801	2,082	1892	101	18	646	593	35,775	37,133
1863	[B]	28	41	69	1878	....	4	176	109	2,401	2,690	1893	100	19	693	535	40,457	41,804
1864	[B]	33	65	98	1879	....	3	215	110	2,761	3,089	1894	123	21	949	508	36,375	37,976
1865	2	39	67	108	1880	9	2	229	115	3,001	3,356	1895	121	26	1,453	576	46,140	48,316
1866	1	42	83	126	1881	29	1	287	122	3,601	4,040	1896	145	18	2,444	543	47,221	50,371
1867	1	51	120	172	1882	58	2	330	136	4,538	5,064	1897	166	14	2,226	571	54,399	57,376
1868	[B]	56	88	144	1883	27	2	365	139	6,002	6,535	1898	184	15	2,376	776	61,610	64,961
1869	[B]	59	202	261	1884	46	3	408	211	10,805	11,473	1899	192	16	2,314	1,426	65,955	69,903
1870	[B]	84	204	288	1885	41	2	465	193	13,925	14,626	1900	358	12	2,347	1,629	75,780	80,126

Europe and Africa, 1901 to Now

	EUROPE														AFRICA					
YEAR	Albania	Austria	Bulgaria	Czechoslovakia	Great Britain	France	Germany	Hungary	Italy	Netherlands	Poland	Rumania	[F] U.S.S.R. (Russia)	Yugoslavia	[F] Total Europe	Egypt	Algeria	Morocco	Total Africa	Australia-N. Zealand	Rest of World
1901	....	....	....	....	....	....	314	....	16	....	3,251	1,678	85,168	....	90,427	....	....	....	....	....	20
1902	....	....	....	....	....	....	354	....	19	....	4,142	2,060	80,540	....	87,115	....	....	....	....	....	26
1903	....	....	....	....	....	....	446	....	18	....	5,235	2,763	75,591	....	84,053	....	....	....	....	....	36
1904	....	....	....	....	....	....	637	....	26	....	5,947	3,599	78,537	....	88,746	....	....	....	....	....	40
1905	....	....	....	....	....	....	561	....	44	....	5,766	4,421	54,960	....	65,752	....	....	....	....	....	30
1906	....	....	....	....	....	....	579	....	54	....	5,468	6,378	58,897	....	71,376	....	....	....	....	....	30
1907	....	....	....	....	....	....	757	....	60	....	8,456	8,118	61,851	....	79,242	....	....	....	....	....	30
1908	....	....	....	....	....	....	1,009	....	51	....	12,612	8,252	62,187	....	84,111	....	....	....	....	....	30
1909	....	....	....	....	....	....	1,019	....	42	....	14,933	9,327	65,970	....	91,291	....	....	....	....	....	20
1910	....	....	....	....	....	....	1,032	....	51	....	12,673	9,724	70,337	....	93,817	....	....	....	....	....	20
1911	....	....	....	....	....	....	1,017	....	75	....	10,519	11,108	66,184	....	88,903	21	....	....	21	....	20
1912	....	....	....	....	....	....	1,031	....	54	....	8,535	12,976	68,019	....	90,615	214	....	....	214	....	20
1913	....	....	....	....	....	....	857	....	47	....	7,818	13,555	62,834	....	85,111	98	....	....	98	....	20
1914	....	....	....	....	....	....	781	....	40	....	6,436	12,827	67,020	....	87,104	753	1	....	754	....	20
1915	....	....	....	....	....	....	703	....	44	....	5,352	12,030	68,548	....	86,677	212	4	....	216	....	10
1916	....	....	....	....	....	....	656	....	51	....	6,587	8,945	65,817	....	82,056	404	8	....	412	....	25
1917	....	....	....	....	....	[G]	642	....	41	....	6,228	3,721	63,072	....	73,704	943	9	....	952	....	29
1918	....	....	....	....	....	363	270	....	35	....	6,032	8,730	27,168	....	42,598	1,935	7	....	1,942	....	25
1919	....	....	....	48	2	334	265	....	35	....	6,096	6,618	31,752	....	45,150	1,517	5	....	1,522	....	20
1920	....	....	....	69	3	356	246	....	35	....	5,607	7,435	25,430	....	39,181	1,042	4	....	1,046	....	20
1921	....	....	....	94	3	389	274	....	32	....	5,167	8,368	28,968	....	43,295	1,255	3	....	1,258	....	20
1922	....	....	....	120	1	496	319	....	31	....	5,227	9,843	35,692	....	51,729	1,188	9	....	1,197	....	22
1923	....	....	....	74	1	494	346	....	34	....	5,402	10,867	39,147	....	56,365	1,054	9	....	1,063	....	24
1924	....	....	....	76	2	497	406	....	39	....	5,657	13,369	45,355	....	65,401	1,122	11	....	1,133	....	24
1925	....	....	....	158	3	459	541	....	61	....	5,960	16,650	52,448	....	76,280	1,226	12	....	1,238	....	23
1926	....	....	....	150	2	478	653	....	41	....	5,844	23,314	64,311	....	94,793	1,188	9	....	1,197	....	17
1927	....	....	....	112	2	504	663	....	47	....	5,342	26,368	77,018	....	110,056	1,267	8	....	1,275	....	13
1928	....	....	....	94	1	512	630	....	46	....	5,492	30,773	[D]84,745	....	122,293	1,842	8	....	1,850	....	15
1929	....	....	....	93	....	535	704	....	45	....	4,988	34,758	[D]99,507	....	140,630	1,868	20	....	1,888	....	38
1930	....	....	....	157	[B]	523	1,182	....	59	....	4,904	41,624	[D]125,555	....	174,004	1,996	16	....	2,012	....	40
1931	....	....	....	134	[E]	520	1,606	....	124	....	4,662	49,127	162,842	....	219,015	2,038	[E]	....	2,038	....	54
1932	....	....	....	126	[E]	530	1,608	....	208	....	4,116	53,815	154,367	....	214,770	1,895	[E]	7	1,902	....	62
1933	11	....	....	122	[E]	562	1,665	....	204	....	4,072	54,020	154,840	....	215,496	1,663	[E]	7	1,670	....	71
1934	10	....	....	178	[E]	557	2,187	....	151	....	3,913	62,063	174,318	....	243,377	1,546	[E]	6	1,552	....	96
1935	41	44	....	133	[E]	541	2,996	....	119	....	3,812	61,310	182,386	2	251,384	1,301	[E]	4	1,305	5	4
1936	273	50	....	127	[E]	503	3,115	....	123	....	3,789	63,659	186,206	1	257,846	1,278	[E]	4	1,282	5	4
1937	619	221	....	123	[E]	502	3,176	16	110	....	3,716	52,452	193,241	4	254,180	1,196	[E]	22	1,218	4	4
1938	752	383	....	130	[E]	513	3,861	288	101	....	3,763	48,487	204,956	9	263,243	1,581	[E]	27	1,608	4	4
1939	934	1,240	....	120	....	500	4,487	1,103	91	....	3,898	45,648	216,866	10	274,897	4,666	[E]	27	4,693	3	4
1940	1,497	2,808	....	163	124	496	7,371	1,881	85	....	3,891	43,168	218,600	10	280,094	6,505	[E]	27	6,532	3	14
1941	1,334	4,238	....	183	223	414	6,303	3,183	95	....	1,793	40,517	238,150	10	296,443	8,546	[E]	27	8,573	3	.....
1942	1,601	5,899	....	271	605	463	5,191	5,037	101	....	2,794	42,094	227,470	10	291,536	8,275	[E]	41	8,316	2	.....
1943	1,001	7,478	....	200	839	356	4,973	6,347	86	1	3,500	39,182	200,750	10	264,723	8,953	.....	39	8,992	2	.....
1944	334	8,218	....	185	703	300	6,154	6,277	55	12	3,000	26,191	275,000	220	326,649	9,416	4	32	9,452	2	.....
1945	267	3,074	....	91	532	202	3,935	5,018	53	41	750	34,772	148,953	200	197,888	9,406	2	26	9,434	3	.....
1946	1,000	5,734	....	196	412	368	4,539	5,146	83	435	866	31,434	157,673	160	208,046	9,070	1	20	9,091	2	.....
1947	2,000	6,285	....	210	351	356	4,032	4,330	81	1,478	951	28,552	187,463	290	236,379	8,627	1	21	8,649	2	.....
1948	1,500	6,149	....	204	323	369	4,489	3,647	71	3,443	1,039	34,000	218,000	270	273,504	13,398	1	100	13,499	3	.....
1949	2,188	6,100	....	292	338	411	5,947	3,791	71	4,314	1,125	33,700	237,700	470	296,447	15,997	2	136	16,135	8	.....
1950	2,800	10,200	....	292	340	909	8,107	3,700	63	4,897	1,205	32,000	266,200	780	331,493	16,373	24	305	16,702	8	.....
1951	1,200	15,500	....	644	335	2,036	9,681	3,500	135	4,942	1,502	31,000	285,000	1,067	356,542	16,311	49	587	16,947	7	.....
1952	1,100	18,760	....	740	407	2,377	12,435	3,500	487	4,975	1,700	45,000	322,400	1,091	414,972	16,464	348	749	17,561	9	....
1953	1,400	21,860	....	900	410	2,555	15,505	5,000	656	5,701	1,800	67,000	363,000	1,236	487,023	16,501	641	761	17,903	8	.....
1954	1,600	23,400	536	1,100	450	3,616	19,008	7,500	535	6,535	2,000	70,000	411,000	1,557	548,837	13,774	570	881	15,225	7	.....
1955*	1,871	24,852	1,000	1,117	394	6,409	22,345	12,208	2,536	7,137	2,864	78,815	514,433	1,736	677,717	12,740	434	758	13,932	23	.....
1956*	2,441	23,268	1,600	1,201	489	9,103	24,894	7,630	4,822	7,652	1,363	81,387	571,208	2,120	739,178	12,174	293	720	[‡]13,249	18	.....
Total	27,774	195,761	3,136	10,427	7,295	41,408	210,722	89,102	12725	51,563	291,047	1,630,788	9,029,789	11,276	11,612,813	240,839	2,513	5,334	248,748	131	1,044

[B] Less than 1,000 barrels. [C] Estimated production. [D] Year ended September 30. [E] No more data. [F] Includes fields in Russian Asia, other than Sakhalin.
[G] France's earlier production credited to Germany. [‡] Includes 62,000 barrels from Angola. * WORLD OIL from private sources.



World Oil Demand . . . at record level with rapid increases forecast.

World demand for petroleum continued to grow during 1956 to an all-time high of 17,533,000 barrels per day, a gain of 1,464,000 barrels daily for a percentage increase of 9.11 over 1955 demand figures. At the same time, total world supply rose to 17,757,100 barrels per day, for an increase of 1,488,800 barrels daily, a 9.15 percent rise from the previous year.

There was a net excess of supply over demand of 224,100 barrels daily, probably representing both the large amount of oil that goes into storage as part of the growing trade in oil, and also indicating that on a world-wide basis the oil market is a buyer's market. During the past three years, excess supply over demand increased from 112,600 barrels per day in 1954 to 199,300 barrels in 1955 and to 224,100 barrels in 1956.

Blocking of the Suez Canal and sabotage of Iraq Petroleum Company's pipe lines in Syria had less effect on 1956 supply-demand figures than might be expected, since both occurred late in the year, and loaded tankers afloat at the time these disruptions occurred discharged their cargoes still later in 1956. However, apparently due to U. S. emergency oil shipments to Europe and the virtual shutoff of shipments of Middle East oil into the U. S. in December, the excess of U. S. demand over supply dropped from 884,000 barrels daily in 1955 to 817,600 barrels per day in 1956. There was a small corresponding drop in excess demand over supply in figures for all North America for the same reason.

Europe's oil demand continued to grow rapidly, as the continent in general continued its trend toward an oil-fueled economy and somewhat away from its coal-dominated energy consumption picture. However, consumption of all forms of energy is increasing.

Total demand in Europe in 1956, excluding Russia, was 3,063,100 barrels daily, for a 14.69 percent increase above the 1955 figure. At the same time, total domestic supply of petroleum in Europe, outside the U.S.S.R. increased from 527,100 barrels to 557,500 barrels a day, an increase of 5.77 percent.

Despite vigorous drilling programs, there appeared to be little or no hope that European crude production could be increased at anything like the pace of increasing demand. And it is expected that Europe's continued industrial expansion would have to be based on oil during the next several decades, at least for lack of any suitable substitute.

World demand for petroleum has increased from 7,777,900 barrels daily in 1946 to 17,533,000 barrels in 1956, an increase of 9,755,100 barrels daily representing a 125.42 percent boost during the past decade. During the same period, U. S. demand jumped 71.34 percent and demand in Europe outside the U.S.S.R. increased 230.42 percent.

Demand for oil is expected to increase rapidly in the future. Since crude reserves continue to rise, supply may continue to satisfy demand for many years. It is found that demand for oil increases in countries that find indigenous crude reserves. This is not only because of increased availability but also because it affords a better basis for industrialization.

Resulting conservation of foreign exchange reserves often helps toward the same end. And as more nations join the trend of allowing private capital to seek and develop domestic oil supplies, both greater supply and demand may be expected on a world-wide basis. However, as the size and efficiency of tankers increase and as the distance between major producer areas close to deep water and major refining centers in consumer areas become less and less important as an economic factor, development of sources of supply is retarded in land-locked producer areas in large countries.

Development and production in West Texas and certain Rocky Mountain areas in the U. S. are being held back because these areas

are more remote, economically speaking from some large domestic consumer areas than are some prolific Middle East oil fields located close to the Persian Gulf. In Canada, the greater consuming areas are in the southeast, whereas much Alberta production is being held back for lack of markets. In Argentina, large reserves in remote, land-locked Salta province are shut in for lack of transportation, while the nation becomes a bigger net importer of petroleum each year.

U. S. demand for petroleum is expected to increase by 40 percent by 1966 to an approximate figure of 12,260,000 barrels per day. Free World demand abroad is expected to rise by 80 percent in the coming decade. Worldwide demand for petroleum likely could rise to 25 million barrels daily by 1965 and to 35 million a day by 1975.

World Petroleum Demand and Supply, by Regions, for Years 1956, 1955, and 1946

Source: All data from private sources. Crude oil production figures may differ from those in other tables in this issue, which are from U. S. Bureau of Mines and other sources; but such differences are inconsequential.

BARRELS PER DAY

REGION	Domestic Demand	DOMESTIC SUPPLY			Excess Supply Over Demand	Excess Demand Over Supply	Percent of World	
		Crude Oil	Natural Gasoline, Etc.	Total			Domestic Demand	Domestic Supply
1956								
North America	9,735,100	7,869,700	812,800	8,682,500	.....	1,052,600	55.5	48.9
United States	8,757,000	7,151,400	788,000	7,939,400	.....	817,600	49.9	44.7
Canada	721,200	469,900	14,000	483,900	.....	237,300	4.1	2.7
Other North America	256,900	248,400	10,800	259,200	2,300	.....	1.5	1.5
South America	1,107,200	2,832,400	20,400	2,852,800	1,745,600	.....	6.3	16.1
Venezuela	151,400	2,457,900	6,600	2,464,500	2,313,100	.....	0.9	13.9
Other Caribbean Area	197,200	198,700	5,500	204,200	7,000	.....	1.1	1.2
Other South America	758,600	175,800	8,300	184,100	.....	574,500	4.3	1.0
Europe Excl. U.S.S.R.	3,063,100	453,600	103,900	557,500	.....	2,505,600	17.5	3.1
U.S.S.R.	1,702,000	1,680,000	52,000	1,732,000	30,000	.....	9.7	9.8
Airica	447,400	35,300	5,000	40,300	.....	407,100	2.6	0.2
Middle East	382,700	3,457,900	.....	3,457,900	3,075,200	.....	2.2	19.5
Far East, Oceania	1,095,500	429,100	5,000	434,100	.....	661,400	6.2	2.4
Total World	17,533,000	16,758,000	999,100	17,757,100	224,100	.....	100.0	100.0
1955								
North America	9,339,200	7,406,300	787,400	8,193,700	.....	1,145,500	57.6	49.9
United States	8,460,000	6,806,700	772,000	7,578,700	.....	881,300	52.2	46.2
Canada	644,600	354,700	10,800	365,500	.....	279,100	4.0	2.2
Other North America	234,600	244,900	4,600	249,500	14,900	.....	1.4	1.5
South America	1,005,300	2,495,400	21,600	2,517,000	1,511,700	.....	6.2	15.3
Venezuela	127,400	2,157,900	6,000	2,163,900	2,036,500	.....	0.8	13.2
Other Caribbean Area	182,500	176,200	6,400	182,600	100	.....	1.1	1.1
Other South America	695,400	161,300	9,200	170,500	.....	524,900	4.3	1.0
Europe Excl. U.S.S.R.	2,668,800	437,500	96,400	533,900	.....	2,134,900	16.5	3.2
U.S.S.R.	1,469,000	1,420,000	50,000	1,470,000	1,000	.....	9.1	9.0
Africa	425,700	37,900	4,000	41,900	.....	383,800	2.6	0.3
Middle East	346,900	3,246,500	.....	3,246,500	2,899,600	.....	2.1	19.8
Far East, Oceania	958,100	399,200	5,000	404,200	.....	553,900	5.9	2.5
Total World	16,213,000	15,442,800	964,400	16,407,200	194,200	.....	100.0	100.0
1946								
North America	5,352,000	4,906,900	320,200	5,227,100	.....	124,900	68.8	65.9
United States	4,912,000	4,750,500	317,000	5,067,500	155,500	.....	63.2	63.9
Canada	221,500	21,000	1,200	22,200	.....	199,300	2.8	0.3
Other North America	218,500	135,400	2,000	137,400	.....	81,100	2.8	1.7
South America	377,200	1,275,700	7,600	1,283,300	906,100	.....	4.8	16.2
Venezuela	24,400	1,064,300	500	1,064,800	1,040,400	.....	0.3	13.4
Other Caribbean Area	129,200	113,200	3,800	117,000	.....	12,200	1.6	1.5
Other South America	223,600	98,200	3,300	101,500	.....	121,100	2.9	1.3
Europe Excl. U.S.S.R.	808,300	136,400	46,200	182,600	.....	625,700	10.4	2.3
U.S.S.R.	514,700	438,200	9,000	447,200	.....	67,500	6.6	5.7
Africa	160,000	24,500	.....	24,500	.....	135,500	2.1	0.3
Middle East	145,000	690,400	.....	690,400	545,400	.....	1.9	8.7
Far East, Ocean	420,700	67,400	4,200	71,600	.....	349,100	5.4	0.9
Total World	7,777,900	7,539,500	387,200	7,926,700	148,800	.....	100.0	100.0

World Producing Wells . . . exceed 607,000 at end of '56.

THE TOTAL Free World producing oil wells numbered 607,005 at the end of 1956, an increase of 21,712 wells from the close of the previous year for a 3.7 percent increase. The revised total amounted to 585,293 producers at the close of 1955. Daily production per well, however, showed an increase of only 0.2 of a barrel from the 24.2 barrels per well recorded for the previous year.

It would be understandably difficult to obtain a complete and exact accounting of the number and status of all Free World producing oil wells for any given period, even with full cooperation of all governments and producing oil companies throughout the world. In the absence of definite government or company reports from several areas covering complete operations, WORLD OIL has used actual figures furnished by private sources as bases for estimates.

United States. For the fourth consecutive year, the U. S. accounted for more than a half million producing wells at the close of the year. Its 554,774 producers amounted to 17,092 more wells than at the same time of the previous year and accounted for an average daily production of 12.9 barrels of oil.

Canada. Under the impetus of a continuing accelerated drilling program in Western Canada, the country recorded 10,946 producing wells at the close of 1956, 2187 wells more than counted at the close of 1955. The upturn amounted to a significant increase of almost 25 percent. Daily average production per well during 1956 equalled 42.4 barrels of oil. Daily average crude yield per well for the previous year amounted to 46.2 barrels.

Middle East. The world's major crude reserve area also is an area of major crude production. Reporting 678 producing wells at the close of 1956, up 53 from the same period of the previous year, the Middle East accounted for a total daily production averaging almost 5090 barrels.

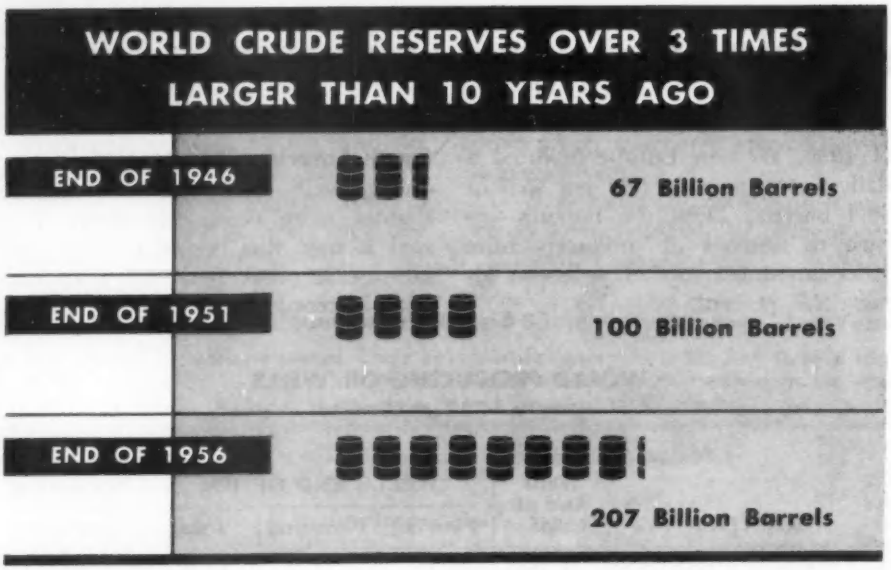
Western Europe. With West Germany accounting for 3010 of its total of 4866 producing wells at the end of 1956, Western Europe reported a daily average production per well of 39.4 barrels. Thus, the region's upturn in number of producers from 1955 amounted to 129 wells—or almost 2.7 percent.

South America. With 26,689 oil producing wells yielding an average of slightly more than 106 barrels per well a day, this region reflected an increase in number of wells from the 24,837 recorded at the close of 1955.

WORLD PRODUCING OIL WELLS
(Excluding U.S.S.R. and Satellites)

COUNTRY	Wells End of 1955	WELLS END OF 1956			1956 Daily Production Per Well (Barrels)
		Flowing	Pumping	Total	
North America, Excl. U.S.	**10,499**	.....	.....	**12,915**	**55.8**
Canada	8,759	.....	.....	10,946	42.4
Cuba	227*	.....	246	246*	6.0
Mexico	1,513	1,169	554	1,723	149.2
South America	**24,837**	.....	.....	**26,689**	**106.1**
Argentina	2,528	115	2,603	2,718	31.9
Bolivia	54	50	23	73	119.6
Brazil	296	.....	.....	328	33.8
Chile	42	52	6	58	166.9
Colombia	1,809	180	1,750	1,930	62.5
Ecuador	1,457	64	1,416	1,480	6.3
Peru	3,056	330	2,883	3,213	15.6
Trinidad	2,780	799	2,125	2,924	27.0
Venezuela	12,815	4,487	9,478	13,965	175.9
Western Europe	**4,737**	.....	.....	**4,866**	**39.4**
Austria	802	.....	.....	834	76.2
France	557	.....	.....	577	43.1
Germany, West	2,808	424	2,586	3,010	22.6
Great Britain	224	.....	221	221	6.1
Italy and Sicily	63	21	23	44	299.4
Netherlands	283	16	264	280	74.7
Africa	**298**	.....	.....	**327**	**110.7**
Algeria	38	.....	.....	35	18.7
Angola	2	.....	.....	6	28.2
Egypt	161	39	151	190	175.1
Morocco	97	.....	.....	96	20.5
Middle East	**625**	.....	.....	**678**	**5,089.5**
Bahrain	106	130	.....	130	231.5
Iran	39	.....	.....	65	8,335.0
Iraq	60	.....	.....	48	13,286.7
Israel	1	7	.....	7	59.3
Kuwait	185	211	.....	211	5,179.0
Neutral Zone	29	44	.....	44	728.1
Qatar	32	33	.....	33	3,745.3
Saudi Arabia	154	114	.....	114	8,650.3
Turkey	19	.....	.....	26	76.7
Far East	**6,609**	.....	.....	**6,751**	**61.0**
Burma	86	.....	100	100	45.9
Taiwan (Formosa)	28	7	24	31	1.8
India	593	.....	.....	602	13.1
Indonesia	1,821	.....	.....	1,972	130.0
Japan	3,512	.....	3,439	3,439	1.7
New Guinea	51	5	47	52	137.6
Pakistan	90	.....	.....	90	64.2
Sarawak-Brunei (Br. Borneo)	428	131	334	465	249.7
Australia-New Zealand	**6**	.....	.....	**5**	**9.8**
Total Free World Outside U.S.	**47,621**	.....	.....	**52,231**	**146.3**
United States	**537,682**	**67,257**	**487,517**	**554,774**	**12.9**
Total Free World	**585,293**	.....	.....	**607,005**	**24.4**

Source: WORLD OIL private sources and estimates.
* Includes naphtha producing wells: 188 in 1955; 200 in 1956.


WORLD CRUDE RESERVES OVER 3 TIMES LARGER THAN 10 YEARS AGO
END OF 1946
67 Billion Barrels
END OF 1951
100 Billion Barrels
END OF 1956
207 Billion Barrels

World Crude Reserves ... Growth of 20 billion barrels during past year expands estimated total to 207 billion barrels.

WORLD CRUDE OIL reserves advanced by 20,057,175,000 barrels from Jan. 1, 1956, to Jan. 1, 1957, a recent WORLD OIL study shows. This upturn represents a 10.9 percent increase from the Jan. 1, 1956, figure. The gain was due primarily to development drilling in many countries, adding significant new supplies of crude oil, and revisions of former figures. The estimated total of world proved crude reserves is put at 207,469,499,000 barrels.

Leading Region. The Middle East continued to dominate the world crude reserves picture, as it is expected in the foreseeable future. There, 148,060,000,000 barrels are estimated as proved, representing more than 71 percent of the worldwide total.

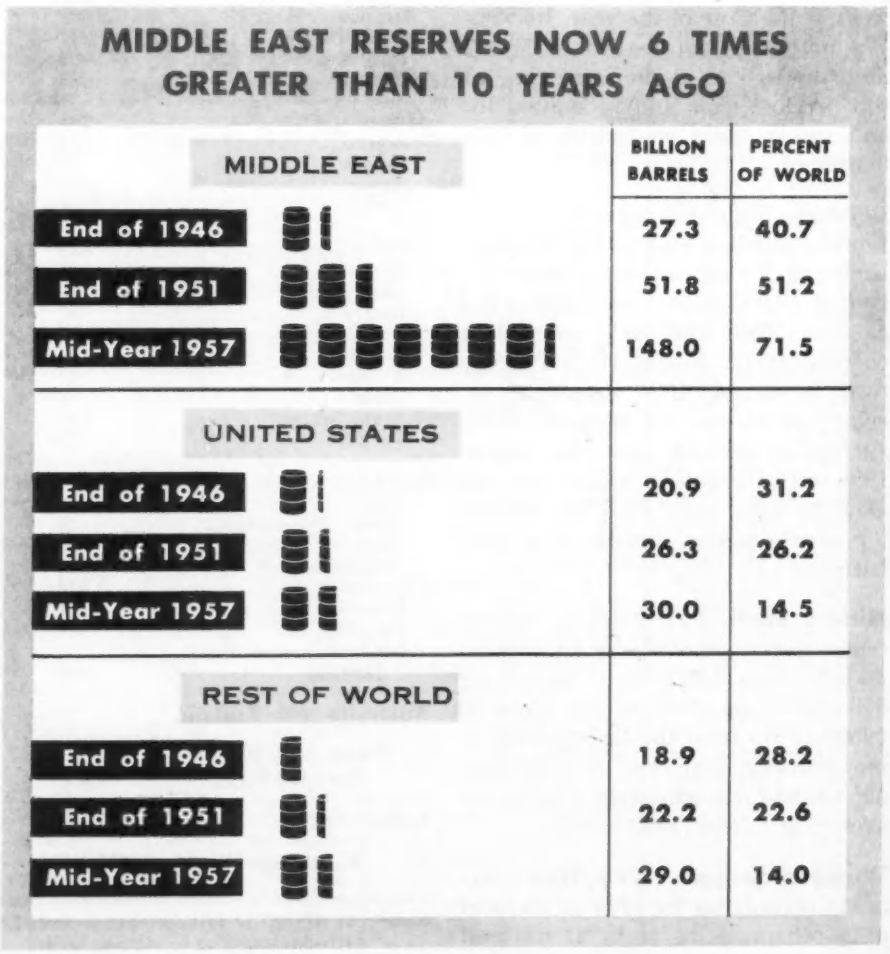
Kuwait still leads all other nations with an estimated 50 billion barrels, unchanged from 1955. As the potentials of the 1955 major discovery at Raudhatain and of two other discoveries made later in North Kuwait had not yet been determined, it was decided to maintain the previous total. There was, however, the expectation that it would be increased in 1958, when more data from wells currently being drilled may be available.

U. S. Position. The U. S. dropped from third to fourth position among the leading oil producing nations—following Kuwait, Saudi Arabia and Iran. U. S. reserves enjoyed a slight increase to 30,434,649,000 barrels. It was hoped that discoveries in the Four Corners area of Utah, Colorado, New Mexico, and Arizona would enhance the U. S. reserves position as developments continued.

Western Europe. Estimates for Western Europe edged upward. Last year, it was thought that France's reserves, largely because of Parentis field, were greater than the 1955 estimate. However, with a revised estimate for 1955, no increase was considered merited.

In addition to Parentis field being essentially drilled up, dolomitization of the pay has been shown to occur only in the center of the structure and not along the flanks as previously was thought.

Africa. Africa shows a significant boost to 320,800,000 barrels, but probable reserves are twice that much.



	BILLION BARRELS	PERCENT OF WORLD
MIDDLE EAST		
End of 1946	27.3	40.7
End of 1951	51.8	51.2
Mid-Year 1957	148.0	71.5
UNITED STATES		
End of 1946	20.9	31.2
End of 1951	26.3	26.2
Mid-Year 1957	30.0	14.5
REST OF WORLD		
End of 1946	18.9	28.2
End of 1951	22.2	22.6
Mid-Year 1957	29.0	14.0

Probable reserves of a strip running from Compagnie Francaise des Petroles (Algerie) Ouargla 1 five miles southward to SN REPAL's Hassi Messaoud 1, thence south-southeast seven miles to Hassi Messaoud 2 could be put at perhaps 600 million barrels alone, without considering other Algerian crude sources at Edjele, Tiguentourine, Talemzane, and Oued Gueterini.

However, only a nominal amount of acreage surrounding each productive well in the Hassi Messaoud area has been considered proved, leaving further drilling with the duty of proving that the indicated major field is continuous, as it appears.

Far East. In India, a major reserve is being proved at Nahorkatiya in Upper Assam, and reserves have risen sharply to an estimated 300 million barrels. A discovery at nearby Moran also enhances India's reserve status.

In Indonesia, the Minas oil field in Sumatra continued to outpace all previous expectations. Qualified sources insist that the 6-billion-barrel figure represents a minimum for Indonesia's proved reserves, hence WORLD OIL's figure has been raised.

Free World Proved Crude Oil Reserves

Reserves estimated by WORLD OIL with aid of oil companies and other sources.
(Thousands of Barrels)

Continent and Country	RESERVES			PRODUCTION IN 1956		Ratio of Reserves to 1956 Production
	Jan. 1, 1956 (Revised)	Jan. 1, 1957	Percent of World in 1957	Thousands of Barrels	Percent of Free World	
North America	**33,573,700**	**35,037,549**	**16.9**	**2,881,392**	**53.76**	**12.0**
Alaska	500	500	....	.....	....	....
Canada	2,509,500	2,849,400	1.4	169,321	3.15	16.8
Cuba	3,000	3,000	....	543	0.01	5.5
Mexico	1,500,000	1,750,000	0.8	94,096	1.76	18.6
United States	29,560,700	30,434,649	14.7	2,617,432	48,84	11.5
South America	**14,125,000**	**15,945,000**	**7.7**	**1,036,535**	**19.33**	**15.4**
Argentina	350,000	450,000	0.2	31,717	0.59	14.2
Bolivia	70,000	75,000	....	3,196	0.06	23.5
Brazil	35,000	50,000	....	4,059	0.07	12.3
Chile	50,000	50,000	....	3,542	0.07	14.1
Colombia	600,000	750,000	0.4	44,132	0.82	17.0
Ecuador	25,000	30,000	....	3,394	0.07	8.8
Peru	225,000	250,000	0.1	18,383	0.34	13.6
Trinidad	270,000	290,000	0.2	28,929	0.54	10.0
Venezuela	12,500,000	14,000,000	6.8	899,183	16.77	15.6
Europe, Western	**1,150,000**	**1,197,500**	**0.6**	**70,228**	**1.32**	**17.1**
Austria	400,000	420,000	0.2	23,268	0.44	18.1
France	150,000	150,000	0.1	9,103	0.17	16.5
Germany	360,000	367,000	0.2	24,894	0.46	14.7
Great Britain	5,000	5,500	....	489	0.01	11.3
Italy and Sicily	125,000	145,000	0.1	4,822	0.09	30.1
Netherlands	110,000	110,000	....	7,652	0.15	14.4
Africa	**269,000**	**320,800**	**0.1**	**13,249**	**0.26**	**24.2**
Algeria	2,000	25,000	....	293	0.01	85.3
Egypt (Including Sinai)	250,000	275,000	0.1	12,174	0.23	22.6
Morocco	7,000	7,000	....	720	0.01	9.7
Other Africa	10,000	13,800	....	62	0.01	222.6
Asia, Total	**137,871,475**	**154,968,150**	**74.7**	**1,358,271**	**25.33**	**109.6**
Asia, Middle East	**133,011,800**	**148,060,000**	**71.4**	**1,262,943**	**23.57**	**117.2**
Bahrain	175,000	160,000	0.1	11,014	0.21	14.5
Iran	26,000,000	32,000,000	15.4	198,289	3.70	161.4
Iraq	15,000,000	22,000,000	10.6	233,421	4.35	94.3
Israel	1,800	15,000	....	152	0.01	98.7
Kuwait	50,000,000	50,000,000	24.1	399,874	7.46	125.0
Neutral Zone	250,000	300,000	0.2	11,725	0.21	25.6
Qatar	1,500,000	1,500,000	0.7	45,345	0.85	33.1
Saudi Arabia	40,000,000	42,000,000	20.3	360,923	6.74	116.4
Turkey	85,000	85,000	....	2,200	0.04	38.6
Asia, Far East	**4,859,675**	**6,908,150**	**3.3**	**95,328**	**1.76**	**45.8**
Burma	43,500	43,000	....	1,680	0.03	25.6
India	250,000	300,000	0.2	2,876	0.05	104.3
Indonesia	4,000,000	6,000,000	2.9	38,347	0.72	64.0
Japan	21,000	22,000	....	2,169	0.04	10.1
New Guinea	15,000	13,000	....	2,618	0.05	5.0
Sarawak-Brunei (Br. Borneo)	510,000	510,000	0.3	45,503	0.84	11.2
Taiwan (Formosa)	175	150	....	21	....	7.1
Pakistan	20,000	20,000	....	2,114	0.03	9.5
Australia-New Zealand	**500**	**500**	....	**18**	....	**27.8**
TOTAL WORLD	**186,989,675**	**207,469,499**	**100.0**	**5,359,693**	**100.0**	**38.6**

CONVERSION FACTORS

COUNTRY	BARRELS PER TON			TONS PER BARREL	
	Long Tons	Metric Tons	Short Tons	Long Tons	Metric Tons
North America:					
Canada	7.891	7.766	7.046	.12673	.12877
Mexico	7.281	7.166	6.501	.13734	.13955
United States	7.459	7.341	6.660	.13406	.13621
South America:					
Argentina	7.134	7.021	6.370	.14017	.14242
Bolivia	7.841	7.717	7.001	.12754	.12959
Colombia	7.143	7.030	6.378	.13999	.14224
Ecuador	7.707	7.585	6.881	.12975	.13183
Peru	7.661	7.540	6.840	.13054	.13264
Trinidad	7.193	7.079	6.422	.13903	.14126
Venezuela	6.958	6.848	6.212	.14372	.14603
Europe:					
Albania	6.706	6.600	5.988	.14912	.15151
Austria	6.897	6.788	6.158	.14500	.14733
Czechoslovakia	6.891	6.782	6.153	.14513	.14746
England	7.440	7.322	6.643	.13440	.13656
France	7.177	7.064	6.408	.13933	.14157
Germany	7.129	7.017	6.365	.14027	.14252
Hungary	7.754	7.631	6.923	.12896	.13103
Italy	7.800	7.677	6.964	.12821	.13027
Poland	7.526	7.407	6.720	.13288	.13501
Roumania	7.525	7.406	6.719	.13288	.13501
U.S.S.R. (Except Sakhalin)	7.390	7.273	6.598	.13532	.13749
Africa:					
Egypt	7.116	7.003	6.354	.14053	.14279

COUNTRY	BARRELS PER TON			TONS PER BARREL	
	Long Tons	Metric Tons	Short Tons	Long Tons	Metric Tons
Asia (Middle East):					
Bahrein	7.446	7.328	6.648	.13431	.13647
Iran (Persia)	7.669	7.548	6.847	.13039	.13248
Iraq	7.600	7.480	6.786	.13159	.13370
Kuwait	7.482	7.364	6.680	.13365	.13580
Saudi Arabia	7.537	7.418	6.729	.13267	.13480
Asia (Far East):					
Borneo	7.345	7.229	6.558	.13614	.13833
India	7.355	7.239	6.567	.13596	.13814
Japan	7.143	7.030	6.378	.13999	.14224
Netherlands Indies	7.911	7.786	7.063	.12641	.12844
Sakhalin (U.S.S.R.)	6.930	6.820	6.188	.14430	.14662
Sarawak	6.762	6.655	6.038	.14788	.15025

API Gravity Conversion Factors

COUNTRY	BARRELS PER TON			TONS PER BARREL	
	Long Tons	Metric Tons	Short Tons	Long Tons	Metric Tons
28° Crude Oil	7.220	7.106	6.446	.1385	.1407
32° Crude Oil	7.401	7.284	6.608	.1351	.1373
36° Crude Oil	7.582	7.462	6.770	.1319	.1340
40° Crude Oil	7.763	7.641	6.931	.1288	.1309
44° Crude Oil	7.945	7.819	7.094	.1259	.1279

Conversion Factors for Lengths, Areas, Weight and Volumes

Acres multiplied by:
43560 = square feet
4840 = square yards
4046.873 = square meters
0.00156 = square miles
0.00405 = square kilometers
0.4047 = hectares
5645.4 = square varas (Texas)
40.47 = ares

Atmospheres (at mean sea level) multiplied by:
14.70 = pounds per square inch
76 = centimeters of mercury
29.92 = inches of mercury

Barrels (U.S.) multiplied by:
9702 = cubic inches
5.6146 = cubic feet
0.15898 = cubic meters
34.9726 = Imperial gallons
42 = U.S. gallons
158.984 = liters
0.1588 = metric tons (water 60°F.)
. . . . = tons of crude oil (see crude oil conversion factors table)

Centare multiplied by
1 = square meters

Centimeters, Linear multiplied by:
0.3937 = inches
0.0328 = feet
0.01094 = yards
0.01 = meters
10 = millimeters

Centimeters, Cubic multiplied by:
0.0610 = cubic inches
0.0353 = cubic feet
0.0000013 = cubic yards
0.000001 = cubic meters
0.001 = decimeters

Centimeters, Square multiplied by:
0.1549 = square inches
0.0001 = square meters
100 = square milimeters

Feet, Linear multiplied by:
12 = inches
0.3333 = yards
30.48 = centimeters
0.3048 = meters
0.0003 = kilometers
0.3600 = varas (Texas)

Feet, Cubic multiplied by:
1728 = cubic inches
0.03704 = cubic yards
28,317.016 = cubic centimeters
283,170 = cubic decimeters
28.317 = liters
0.02832 = cubic meters
7.4805 = U.S. gallons
6.288 = Imperial gallons
0.17811 = U.S. barrels

Feet, Square, multiplied by:
144 = square inches
0.1111 = square yards
0.0929 = square meters
929.03 = square centimeters

Gallon, U.S. multiplied by:
128 = ounces
4 = quarts
8 = pints
0.8327 = Imperial gallons
0.0238 = U.S. barrels
231 = cubic inches
0.1337 = cubic feet
3785.332 = milliliters
3.78553 = liters
3785.43 = cubic centimeters
0.003785 = cubic meters

Gallons, Imperial multiplied by:
277.42 = cubic inches
0.16054 = cubic feet
4.54596 = liters
0.0045461 = cubic meters
1.2010 = U.S. gallons
0.028594 = U.S. barrels

Hectares multiplied by:
2.471 = square miles
0.00386 = square miles
10,000 = square meters

Inches, Linear multiplied by:
0.0833 = feet
0.02777 = yards
0.0254 = meters
2.54 = centimeters
25.4 = millimeters

Inches, Cubic multiplied by:
0.000578 = cubic feet
0.000021 = cubic yards
16.3871 = cubic centimeters
0.016387 = cubic decimeters
0.0163865 = cubic liters
0.0000163 = cubic meters
0.0036 = Imperial gallons
0.00433 = U.S. gallons
0.5541 = ounces
0.0173 = quarts

Inches, Square multiplied by:
0.0069 = square feet
0.00078 = square yards
6.4516 = square centimeters
0.0006 = square meters

Kilograms multiplied by:
2.20462 = pounds
.0011023 = short tons

Kilograms Per Square Centimeter multiplied by:
14.233 = pounds per square inch

Kilograms Per Square Meter multiplied by:
0.2048 = pounds per square foot
0.001422 = pounds per square inch
0.0000968 = atmosphere

Kiloliters multiplied by:
35.31 = cubic feet
264.14 = U.S. gallons
1000 = liters

Kilometers multiplied by:
3280.83 = feet
1093.6 = yards
0.6214 = mile
1000 = meters
10,000 = centimeters

Kilometers, Square multiplied by:
247.1 = acres
0.3861 = square miles

Liters multiplied by:
33.8147 = fluid ounces
1.0567 = quarts
0.2642 = U.S. gallons
0.2200 = Imperial gallons
0.00629 = U.S. barrels (oil)
2.202 = pounds (water 60° F.)
61.0251 = cubic inches
0.0353 = cubic feet
1000.03 = cubic centimeters
0.0013 = cubic yards
0.001 = cubic meters

Mercury (Inches) multiplied by:
0.3342 = atmospheres (mean sea level)
0.4912 = pounds per square inch
345.3 = kilograms per square inch

Meters, Lineal multiplied by:
39.3701 = inches
3.28084 = feet
1.09361 = yards
0.0006 = miles
100 = centimeters
0.01 = kilometers
1000 = millimeters

Meters (Cubic) multiplied by:
61,023.38 = cubic inches
35.31445 = cubic feet
1.30796 = cubic yards
1,000,000 = cubic centimeters
999.97 = liters
264.17 = U.S. gallons
219.97 = Imperial gallons
6.2898 = U.S. barrels (oil)

Meters, Square multiplied by:
1550 = square inches
10.764 = square feet
1.1959 = square yards
10,000 = square centimeters
0.0001 = hectares
0.0002471 = acres
1 = centare

Miles multiplied by:
5280 = feet
1760 = yards
1609.3472 = meters
1.6093 = kilometers
1900.8 = varas (Texas)
0.8684 = nautical miles

Miles, Square multiplied by:
3,097,600 = square yards
2,589,998 = square meters
258.9998 = hectares
2.5900 = square kilometers
640 = acres

Milliliters multiplied by:
0.0338 = fluid ounces
0.00026 = gallons
0.001 = liters
0.0610 = cubic inches

Millimeters multiplied by:
0.03937 = inches
0.001 = meters

Ounces (Fluid) multiplied by:
0.0078 = gallons
1.8047 = cubic inches
0.0295 = liters
29.5729 = milliliters
28.35 = grams
16 = pounds

Poods multiplied by:
36.113 = pounds

Pounds multiplied by:
16 = ounces
0.0005 = short tons
0.4536 = kilograms
0.0277 = poods

Pounds per Square Inch multiplied by:
0.06804 = atmospheres
703.066 = kilograms per square meter
2.036 = inches of mercury

Tons (Long) multiplied by:
2240 = pounds
1.01605 = metric tons
1.120 = short tons
1016 = kilograms

Tons (Metric) multiplied by:
0.9842 = long tons
2204.6223 = pounds
1.1023 = short tons
1000 = kilograms
6.297 = U.S. barrels (water 60° F.)

Tons (Short) multiplied by:
2000 = pounds
0.8929 = long tons
0.9072 = metric tons
907.2 = kilograms

Varas multiplied by:
2.7408 = feet (in Mexico)
2.7425 = feet (in Chile, Peru, Spain)
2.8408 = feet (in Argentina)
3.6083 = feet (in Portugal)
2.775 = feet (in Texas)
0.838 = meters (in Mexico)
0.8359 = meters (in Chile, Peru, Spain)
0.866 = meters (in Argentina)
0.8467 = meters (in Texas)
1.1 = meters (in Portugal)

Varas (Square) multiplied by:
0.0001774 = acres

Yards (Linear) multiplied by:
36 = inches
3 = feet
0.9144 = meters
91.4402 = centimeters
0.1200 = varas

Yards (Cubic) multiplied by:
46.656 = cubic inches
27 = cubic feet
764,559.4 = cubic centimeters
764.6 = liters
0.76445 = cubic meters

Yards (Square) multiplied by:
1296 = square inches
9 = square feet
8361.307 = square centimeters
0.8361 = square meters

LIQUID MUSCLE FOR INDUSTRY

High on the list of American business achievement stands the swift efficient movement of millions of tons of material – made possible by an endless variety of automatic, time-and-labor saving machinery. Petroleum plays a vital role in this development. In the hydraulic cylinders of lift trucks, for example, move petroleum liquids that revolutionized the art of fast, cost-controlled distribution. Texaco scientists pioneered in creating these amazing hydraulic fluids which change pounds of pressure into tons of lift. The chemical sinews of these liquid muscles are the result of a partnership of research and industry in which Texaco scientists daily seek the new way, the better way.

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Around the world in 150 pages . . .

This special International Outlook Issue of WORLD OIL is divided here for your reading convenience. The preceding pages have evaluated trends and set forth statistics on the world-wide oil industry and covered such areas as Venezuela, Canada, Africa, Western Europe, and Russia. The following pages contain detailed summaries of all other countries where oil is sought or produced; also a review of oil laws around the world (Page 323).

Alaska . . . Richfield discovery on Kenai peninsula may increase interest of other companies.

In mid-1957, Richfield Oil Corporation reported an oil discovery by its Alaska test in what may prove to be the biggest discovery in the company's history and cause for intensified interest in Alaskan operations by other companies.

Richfield's Swanson River Unit 1, on the Kenai peninsula 40 miles southwest of Anchorage, flowed during production tests at a rate of more than 200 barrels a day of 31-gravity crude at a depth of 11,140-11,170 feet. Drilling was continuing and more pay zones were encountered.

The Katalla-Yakataga area, where Phillips Petroleum Company and Kerr-McGee Oil Industries, Inc., were conducting operations, is the site of the companies' latest test. Sullivan 2 was spudded in Jan. 23, 1956, and was drilling at 10,445 feet on Jan. 1, 1957.

Initial preparations, including building of roads and camp facilities, were under way in August, 1957, for the Humble Oil & Refining Company and Shell Oil Company wildcat to be drilled in the Bear Creek area of the Kanatka region, 300 miles southwest of Anchorage. The test will be drilled on a Shell Oil lease.

Phillips Petroleum conducted surface geological work for three months in the Port Moller and Chignik areas, using a party of three men based on a boat and using a helicopter for transportation.

During August, 1956, Texota Oil Company, controlled by F. Kirk Johnson of Fort Worth, Texas, became interested in the Yukon. Oil leases covering more than 100,000 acres between Nulato and Koyukuk were filed in August, 1956.

The status of Naval Petroleum Reserve 4 remained unchanged since operations in the Reserve were suspended in 1953. While no crude was produced in the Reserve during 1956 or until August, 1957, five wells were reported shut in as of Dec. 31, 1956, at Umiat field. Two gas wells in South Barrow field produced almost 103.5 MMcf during the year.

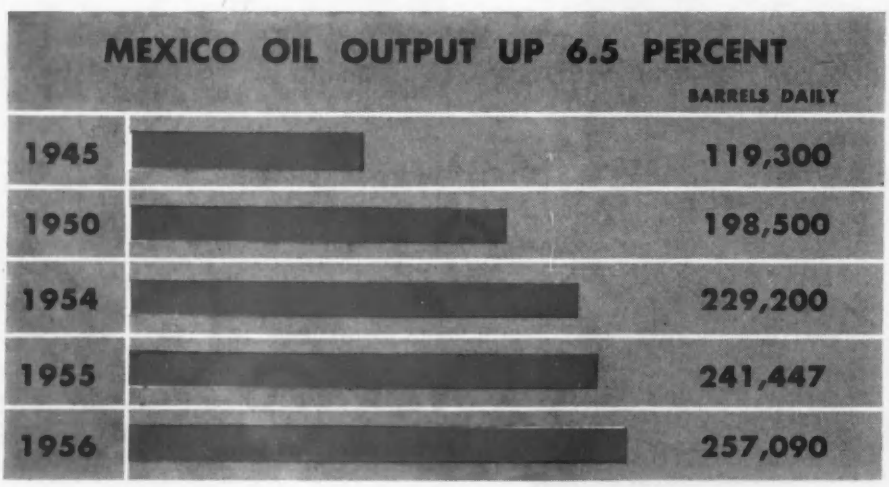
Proved crude reserves on the Reserve as of Dec. 31, 1956, were limited to Umiat field and amounted, according to DeGolyer and MacNaughton estimates, to 57 million barrels. The reserves' two gas fields—South Barrow and Gubic—were estimater to have proved natural gas reserves of 5 billion cubic feet to 7 billion cubic feet and 22 billion cubic feet, respectively.

Mexico . . . Continuing trend of field discoveries outstanding '56-'57 development.

LIVING UP to expectations, the year 1956 overshadowed previous record years of Mexico's oil industry development. In 1956 and 1957, the continuing trend of new field discoveries was the most significant factor. Though some of the new discoveries added but little to the nation's crude output during 1956 and were not expected to add greatly to the total yield this year, several are of major importance and represent a substantial increase to crude reserves. Thus, they combine to assure Mexico a bright future.

Outstanding developments during the 12 months period ending in the first quarter of 1957 included the discovery of production in the Jurassic formation for the first time in the history of Mexican oil; discovery of the San Andres field, south of Papantla, Veracruz, which appears to be the nation's largest discovery during the past 25 years; and the discovery of natural gas in the Veracruz Basin, about 65 miles from the port of Veracruz.

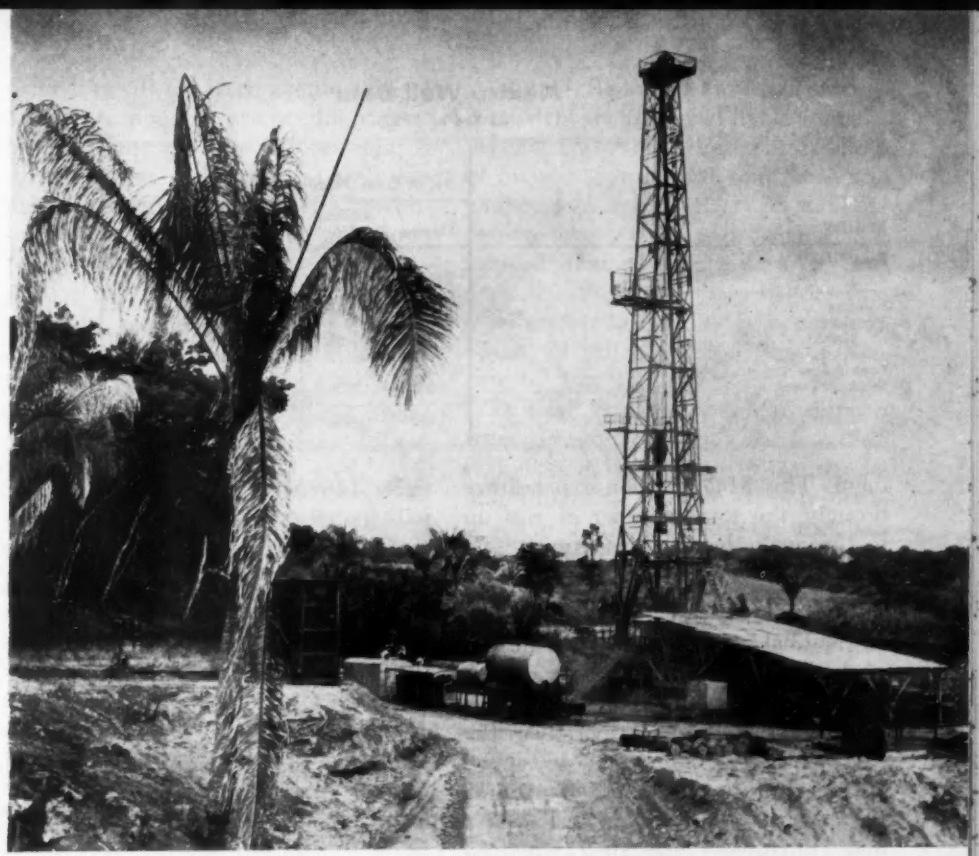
The Jurassic discovery opened the propects that new production possibly could be obtained in all of the areas that have been produced during the past 25 years and even in areas that were non-productive in horizons shallower than this new, deeper formation.



The Veracruz Basin gas discovery assured the port area of a plentiful supply of fuel for industrial development.

At the beginning of 1957, Petroleos Mexicanos, the Mexican oil monopoly had under way a $94 million-plus construction program which was expected to be completed during the following 23 months. This program includes:

- Oil pipe line from Tamaulipas field to port of Tampico, Tamaulipas.
- An oil pipe line from Xacotla, Veracruz, to Alamo, Veracruz.
- A natural gas pipe line from the Reynosa field to Monterrey, Nuevo Leon.
- A system of high pressure lines at the absorption plant at Reynosa.
- Installation of a 25,000 barrel daily catalytic cracking plant at the Mexico City refinery.
- Modernization of the Arbol Grande refinery.
- Construction of a 25,000 barrel daily catalytic cracking plant and new electric power and steam plants at the C. Madero (Tampico) refinery.
- Completion of the 300 million cubic foot daily gas absorption plant at Ciudad Pemex, in Tabasco State.
- Extension of the gas collection system in Poza Rica to handle the gas from the New Golden Lane fields.
- Completion of the dry docks at San Juan de Ulua, Veracruz.



Universal Trade Press Syndicate photo

This drilling rig is one used by Petroleos Mexicanos in the development of Mexico's new field, San Andres, which was discovered in 1956. Located about 31 miles southeast of Poza Rica, the promising new discovery area produces 20-gravity crude from Checontepec sands of the Lower Eocene at between 9000-10,000 feet.

Drilling. Drilling was stepped up sharply during 1956—exceeding the total completions of 1955 by 76 wells, or 23 percent—to reach 406 completions. Total footage drilled amounted to 2,172,387 feet, and accounted for an average depth per well figure of 5350 feet. This compares with the 1955 average depth per well figure of 5423 feet, resulting from the completion of 330 wells for total footage of 1,789,805 feet.

Of the 1956 completions, 88 were wildcats and 318 were development wells. Results from wildcat tests were 23 oil producers, 10 gas wells and 55 dry holes. Of the development wells, 197 found oil, 41 were gas producers and 80 wells were failures.

As a further indication that drilling during 1957 would be increased sharply, Pemex purchased last year 20 new drilling rigs, together with additional field equipment necessary to put them into operation, such as tractors and other transport equip-

Oil Production in Mexico

DISTRICT	Daily Average in 1956	Year, 1956	Daily Average in 1955	Year, 1955
Poza Rica:				
Poza Rica	116,983	42,815,980	109,483	39,961,238
New Golden Lane	60,447	22,123,735	71,007	25,917,486
Tampico:				
North	20,371	7,456,033	13,393	4,888,343
South	16,221	5,937,214	15,935	5,816,438
Central Zone	14,986	5,485,070	6,658	2,430,292
Frontera	4,626	1,693,285	3,749	1,368,528
Southern Zone:				
Isthmus of Tehuantepec and Tabasco	23,456	8,585,038	21,222	7,745,984
Total	257,090	94,096,355	241,447	88,128,309

Drilling in Mexico

All by Petroleos Mexicanos, Government Agency

	WELLS COMPLETED IN 1956								WELLS COMPLETED IN 1955			
	Development Wells			Wildcats			Total					
DISTRICT	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage	Oil	Gas	Dry	Total
Poza Rica:												
Poza Rica	44	0	9	3	0	7	63	506,237	40	0	2	42
New Golden Lane	42	0	15	6	0	7	70	350,496	52	2	21	75
Frontera	2	21	9	0	6	4	42	308,134	4	25	16	45
Tampico:												
North	15	0	1	3	0	3	22	97,935	1	0	10	11
South	1	1	10	4	0	12	28	103,720	6	2	16	24
Central Zone	16	0	9	3	3	13	44	182,233	15	0	20	35
Southern Zone	77	19	27	4	1	9	137	623,632	70	7	21	98
Total	197	41	80	23	10	55	406	2,172,387	188	36	106	330

TABLE 1

1956 Natural Gas Production in Mexico

(In Cubic Feet)

REGION	Amount
Poza Rica:	
Poza Rica	70,509,560,375
New Golden Lane	13,403,103,811
Tampico:	
North	
South	2,045,407,645
Central Zone	784,290,250
Frontera	31,071,726,955
Southern Zone:	
Isthmus of Tehuantepec and Tabasco	6,976,926,240
Total	124,791,015,276

Mexico Well Data
(At End of 1956)

REGION	No. of Crude Producing Wells			No. of Natural Gas Producing Wells	No. of Wells Shut in
	Flowing	Artificial Lift	Total		
Poza Rica:					
Poza Rica	173	82	255	..	90
New Golden Lane	76	..	76	..	23
Frontera	106	14	120	32	68
Tampico:					
North	416	75	491	..	267
South	247	5	252	..	122
Central Zone	17	..	17	..	..
Southern Zone	134	378	512	..	281
Total	1,169	554	1,723	32	851

ment. This $14.4 million expenditure brought the total number of rigs up to 156, including workover units.

New Discoveries. Pemex' expanding drilling program last year resulted in 18 new fields—a record in the history of the industry. More oil and gas were added to Mexico's reserves than during any other 12-month period in the past 19 years. Best fields developed during 1956 were the San Andres field, in Veracruz State; the Reynosa and Tamaulipas fields in Tamaulipas state; and La Venta field in Tabasco State.

The discovery of gas in known and new fields has increased the nation's reserves to the point that the problem today is no longer the production of this fuel but the locations of markets that will permit gas production on an economic basis.

Exploration. Spearheading the trend toward increasing new field discoveries is Pemex' exploration program. During 1956, Pemex kept 45 geological and geophysical crews in the field. But the big news in this phase of the industry's activities was the report that this year operations were being conducted on Mexico's continental shelf offshore along the Gulf Coast.

Production. Mexico's crude output last year amounted to a daily average of 257,090 barrels—almost 94.1 million barrels for the year—which was an increase of almost 6.5 percent from 1955.

Current daily average production of natural gas was listed at about 342 Mmcf, with a capacity of 950 Mmcf per day. This capacity can be increased by the drilling of additional wells to tremendous amounts when markets are developed.

Of importance to the domestic natural gas industry was the contract between Pemex and Texas Eastern Transmission Corporation under the terms of which Pemex will export initially 115 Mmcf a day. The export will increase gradually until a maximum of 200 Mmcf per day is reached.

This export gas was to be supplied from only three fields—Brazil, Trevino and Lomitas—of the 26 fields comprising the Northeastern district at the border.

Work of laying the gas line from the fields across the river to connect with existing Texas Eastern installations was scheduled to begin following authorization by the U. S. Federal Power Commission for the importing of natural gas into the U. S.

Crude Reserves. At mid-1957 Mexico's Senator Antonio J. Bermudez, director general of Pemex for the past ten years, listed his nation's proved crude reserves as 1,826,000,000 barrels of crude and condensate.

Pipe Lines. Pushing pipe line construction, as the efficient and fastest means of transportation, Pemex built the following lines during 1956:

- Fifty-mile, 20-inch crude line from Angostura field to Veracruz Port to move the 25,000 barrel-a-day production from that field.
- Three hundred and fifty-mile, 12-inch crude line to Monterrey, with an initial capacity of 25,000 barrels daily.
- Fourteen-mile, 12-inch crude pipe line from Tamaulipas field to the Tampico refineries.

Also, Pemex has begun construction of the 156-mile, 22-inch natural gas line from Reynosa field to Monterrey.

Consumption and Exports. Mexico's domestic market consumed an average of 238,600 barrels a day of refined products during the past 12 months, as compared to 212,400 barrels daily during the previous year. Refined products sales topped those of 1954 by more than 9 million barrels.

Mexico exported 23,722,022 barrels of petroleum products in 1956, of which 28 percent was crude oil, as compared to 25,833,602 barrels in 1955 and 23,269,689 barrels in 1954.

Still a top-ranking problem, however, was the nation's need for imports of refined products to meet domestic requirements. Mexico's exports consistently have topped imports, but the sale of crude oil and the purchase of refined products leaves a deficit that cost Mexico more than $70 million in 1956.

Reasons for these imports are the lack of transportation to the north and western parts of the nation from coastal refineries and capital to complete refining facilities.

During the year, Del Mar Drilling Company, Corpus Christi, Texas, bought the control of Northeast Mexico Drilling Company and planned to operate under the latter name from headquarters in Reynosa. The firm company owns two drilling rigs; however, another unit was purchased from Mexican American Independent Company, Mexico City, and a fourth rig was scheduled to be sent to Mexico.

Central America . . . Interest remains high, but exploratory wells fail to find oil.

Oil industry activities or the interest in undertaking them expanded widely throughout the Central American area last year. There was no apparent lessening of interest, although several exploratory wells failed to discover oil, in 1957.

Costa Rica. Union Oil Company of California, encouraged in the fall of 1956 by a substantial, though short lived, flow of high gravity crude in their Cocoles 2 wildcat, continued to explore actively in their 3-million-acre concession in Costa Rica.

Cocoles 2, which reportedly flowed in excess of 1000 barrels daily of over-40 gravity crude, along with high casing and tubing pressures, in a short while developed a very high salt water cut. The water problem could not be solved, and the well was shut in pending further evaluation of surrounding area. The productive zone tested was a 63-foot section at about 4900 feet.

Union Oil's Cocoles 3, located about 3000 feet north of Well 2, was abandoned at an undisclosed depth after penetrating a fault. Cocoles 4, situated in the same general area, was spudded April 12, 1957. At mid-year, the well was drilling below 5700 feet, still above the objective zone.

Although still without commercial production, early in 1957, Union Oil reportedly was planning to spend about $2 million on further exploratory drilling during the year.

Panama. Considerable interest in Panama's oil possibilities has developed from the discovery of oil in southeastern Costa Rica, near the border of Panama, in 1956. Union Oil Company of California has a contiguous concession in Panama. Union's Yorkin 1 test in Panama near the border, was suspended at 5500 feet early in 1957.

Several new concessions have been announced in Panama within the past year. Hydroil, Inc., of Houston, purchased four concessions held by Mas Petroleo early in 1957. More than 2 million acres were involved in the four areas, which include coastal strips on both the Caribbean and Pacific sides, primarily west of the Canal Zone, a large area lying all the way across Western Panama, and a fourth area on the Gulf of Darien Coast.

Seismic and gravity work were reported in progress in Panama. Cataract Mining Corporation of New York reportedly had acquired 3 million acres in oil concessions in Darien and Chiriqui Provinces. International Oil and Metals Corporation of Seattle, Wash., also was reported to have taken a 75 percent interest in a large southeastern Panama concession from Compania Petrolera del Golfo de Darien.

Barbados. Barbados Gulf Oil Company continued exploration throughout 1956. Springvale 1, located eight miles north-northeast of Bridgetown, which had reached a total depth of 12,178 feet with 5½-inch casing landed at 10,330 feet at the start of 1956, underwent extensive tests. Appreciable quantities of gas and distillate were reported. The well was shut in after the tests were concluded to observe pressure buildup characteristics.

Friendship 1, located on the north tip of the Island near St. Lucy was drilled to 10,799 feet at the end of last year. Slightly above this depth, high-pressure gas was encountered. A fishing job resulted and the well was abandoned in February, 1957, without adequate testing of the gas shows having been possible.

Early in 1957, Barbados Gulf was granted a concession covering the half of the Island of Barbados formerly held by British Union Oil Company. Gulf now has the entire island under concession and will continue to explore for oil.

Nicaragua. Early in 1957, Waterford Oil Company was drilling in Nicaraguan waters 25 miles offshore at Touche 1, on an 11-million-acre offshore concession. The test was located 50 miles northeast of Puerto Cabezas in six feet of water on a coral reef.

Drilling contractor was J. Ray McDermott of Houston. The drilling barge in use belongs to Harvey Drilling Company and was towed from South Louisiana. The test was being drilled on a big seismic structure. The well had reached 8700 feet by April 1, 1957.

Gulf Oil Corporation has an interest in Waterford's ventures in offshore Nicaragua waters, and the well probably will be tied in with geological data from two old Gulf wells near Punta Gorda.

Guatemala. In June, 1957, resolution of many overlaps in applications for concessions filed pursuant to the Guatemala Petroleum Code of 1955 was completed and many companies had their exploration programs well under way. More than 20 companies, mostly U. S. concerns, hold interests in about 40 concessions aggregating more than nine million acres. The northern part of the country, in particular Peten Province, is almost solidly blocked with concessions.

See oil law review on Page 332

The larger concession holders are Signal Oil and Gas Company, Ohio Oil Company, Story J. Sloane, Amerada Petroleum Corporation, Sun Production, Standard Oil Company of California, Sohio Petroleum Company, Esso Standard, Union Oil Company, Continental Oil Company, The Shell Oil Company, Atlantic Refining Company, and Tidewater Oil Company.

Story J. Sloane of Houston, intended to drill the first well in Guatemala. Seismic crews have found indications of favorable structural conditions and gas seeps in several places on the concession where the first drillsite will be located. Sloane Exploration Company expected to have a rig on the first location on the Morales concession, about 20 miles west of Puerto Barrios, by July 15, 1957.

Drilling equipment was shipped from Houston July 6. Sloane has 124,000 acres in concessions in Guatemala and intended to drill offshore locations in Amatique Bay on the San Felipe and El Estor concessions. A slim hole rig, capable of 7000 feet, was being used on the first test.

Aero Service Corporation of Philadelphia was completing an airborne magnetometer survey of Peten Province for a group of 15 interested companies in mid-1957.

Haiti. On the island of Gonave, just west of the main island of Haiti, Mark Edwin Andrews, independent oil producer of Houston completed his second and third tests during 1956 and moved the rig back to the U. S. upon completion of the third.

The first test was drilled to 4200 feet in 1955. The second well, drilled early in 1956, was abandoned at a total depth of 8200 feet. The third was drilled to 7000 feet and abandoned also. No favorable reservoir characteristics were reported in the sediments penetrated. The contractor, R. L. Kirkwood, of San Antonio, Texas, was using the same rig for Texas operations by early 1957.

Commonwealth Oil Company remained interested in the possibilities of the main island of Haiti, where it has a 50-year concession.

Jamaica. Pan Jamaican Oil Company is the new name for Jamaican Stanolind Oil Company, which held a concession on the entire island and the surrounding submerged lands to an average of 12 miles offshore. Exploration continued during 1956 with four surface geological crews, one core drill and one seismograph crew.

The company drilled its first test on the island in 1956 at Santa Cruz, five miles south of Malvern and abandoned it in March, 1957, at 8732 feet. Associated Noble Corporation of Tulsa was the drilling contractor.

Pan Jamaican is a wholly owned subsidiary of Pan American Petro-

leum Corporation. Pan Jamaican's second exploratory hole, Cockpit 1, was plugged and abandoned at 5534 feet in May, 1957. The drillsite was in Trelawny parish, about 16 miles south of Falmouth.

Dominican Republic. Early in 1957, latent interest in the oil possibilities of the Dominican Republic and adjoining Haiti came to life with vigorous exploratory activity taking place. There are active oil and gas seepages in the Azua and Enriquillo Valleys. Earlier in the 20th century there was some oil production in Haiti, now abandoned.

Pursuant to the recent institution of a favorable oil law in the Dominican Republic, a syndicate of independent U. S. oil men has been formed to explore for oil in the Dominican Republic. The group, known as Petrolera Dominicana, C. A., has a 2.1 million-acre exploration permit in the Cibao Valley. The following, among other stockholders, are participating in the venture: Howard S. Cole II, and Albert Bel Fay, both of Houston; and Floyd Odlum, president of Atlas Corporation. Pohly Exploration Company of Tulsa was reported conducting gravity work for the group early in 1957, and an Evangeline Seismic Company crew was also reported moving from headquarters in Lafayette, La., to conduct reflection work in the Dominican Republic.

It was expected that a drillable prospect would be found quickly and that a rig would be moved into the Dominican Republic before the end of this year.

Honduras. Early in 1957, John W. Mecom of Houston drilled a test at Laguna Canatasca on the Caribbean Coast to a total depth of 6950 feet without finding commercial production. The concession was acquired from Compania Petrolera Hondurena in 1955 and consists of 48 million acres.

Independent U. S. oil interests recently purchased the stock of Petroleos Hondurenos, S. A., and were preparing to move in a rig to drill the first wildcat on an 11-million-acre concession.

Oil and Gas Property Management, Inc., of Dallas, was instrumental in arranging acquisition of the Honduran firm. Georesearch Inc., D. H. Byrd, American Maracaibo Company, Justiss-Mears Oil Company, McRae Oil and Gas Corporation, and Western Hemisphere, Inc., are partners in the group.

Bahamas. Bahamas Exploration Company, Ltd., a subsidiary of Gulf Oil Corporation and Bahama California Oil Company, Ltd., a Standard of California subsidiary, carried out two months of joint seismic operations. More than 40,000 square miles are under lease in the Bahamas, with Gulf and SoCal subsidiaries being the largest acreage holders. No wells were drilled in the Bahamas during 1956.

British Honduras. British Honduras Gulf Oil Company was drilling its first test on the Yalbac structure, near the Guatemala border 50 miles west of the town of Belize at 6633 feet at the start of 1956. The test was drilled to a total depth of 9005 feet and abandoned. The contract rig, owned by Santa Fe Overseas Drilling Company was moved about 25 miles northeast of Yalbac 1 to Hill Bank 1, which was drilled to 6550 feet, and abandoned also.

Gulf released the rig late in 1956. However, the company was continuing surface geological and photogeological work to determine future drilling locations.

Puerto Rico. A 640,000-acre concession reportedly was granted to William S. Wallis, of Toronto, Canada, and Frank H. Crerie, a Houston banker. General field geology has been carried out by detailed mapping of various parts of Puerto Rico by government and university groups, in addition to that conducted by the holder of the exploration permit covering the north coast.

A Tertiary basin occurs along the northern coast. Another concession was reported to be granted on a seismic structure near the town of Santa Isabel in the South Coast Reservation.

Commonwealth Oil Refining Company's new refinery at Guayanilla Bay went on stream during 1956, with a capacity of 23,250 barrels per day. An expansion of the new plant already was under way to more than double the initial capacity.

Cuba . . .

Jatibonico production off.

See Page 228 for a review of Cuba oil laws.

ALTHOUGH CUBAN oil production in 1956 set a new record, there was a decline throughout the year in the quantity of oil produced in Jatibonico field, the island's largest producer. The previous record crude output of 381,824 barrels, or 1043 barrels per day, in 1955 was topped last year by a significant margin. The 1956 yield, according to Cuba Petroleum News Digest, amounted to 543,121 barrels for a daily average of almost 1484 barrels.

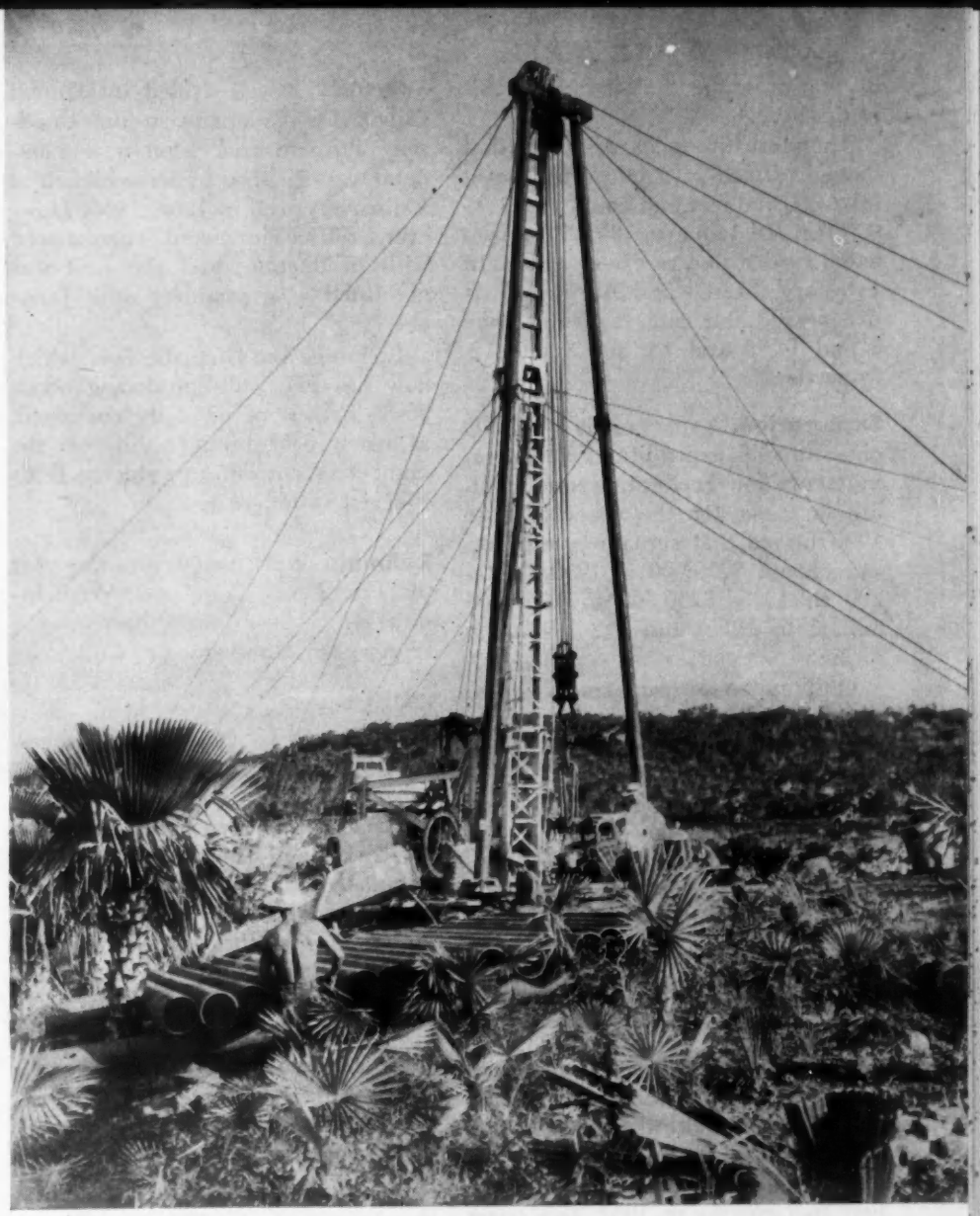
Production in Jatibonico declined from 1200 barrels per day in January, 1956, to 19 barrels daily in December, 1956. Motembo produced about 17 barrels of naphtha a day throughout the year. Output from the Bacuranao-Cruz Verde and Santa Maria del Mar fields in Havana province rose from 67 barrels per day in January, 1956, to 385 barrels a day in December.

In 1957 one new field was added to the six previous producers. Guanabo has two producing wells owned by United Cuban Oil Inc. which were averaging about 25 to 30 barrels per day combined. During 1957, then, crude production was coming from Jatibonico, Catalina, Jarahueca, Bacuranao-Cruz Verde, Santa Maria

Aruba. Lago Oil and Transport Company, Ltd., a Jersey Standard affiliate, continued to operate at capacity its refinery located on Aruba Island 20 miles off Western Venezuela's Paraguana Peninsula in The Netherland Antilles. Lago charged an average of 439,000 barrels daily during 1956, all of it being Venezuelan crude or semi-finished Venezuelan products, such as gas oils. Majority of the supply was shipped to Aruba by Creole Petroleum Corporation, with lesser amounts coming from Compania Shell de Venezuela. The Aruba refinery thus charged a greater volume of oil than any other refinery in the world last year.

del Mar and Guanabo oil fields and Motembo naphtha field.

If the decline in Jatibonico production continued, as appeared likely, and unless new oil fields were discovered this year, it was probable that production for 1957 would be about 400,000 barrels for a daily average yield of 1095 barrels. Cuba consumes from 55,000 barrels to 60,000 barrels of oil products daily.



Here 10¾-inch casing is being lowered to 620 feet in this well being drilled in Cuba's Cruz Verde field east of Havana. Well is owned by Consolidated Cuban Petroleum Corporation.

Drilling. In January, 1956, 11 rotary rigs and 12 cable tool rigs were active in Cuba, and in December 8 rotary rigs and 14 cable tool rigs were in operation. At the beginning of 1956, it was anticipated by *Cuba Petroleum News Digest* that footage drilled during the year would reach 500,000 feet, or about twice the 1955 figure of 249,831 feet. However, only 278,515 feet of hole was drilled, excluding core drilling, reported CPND.

Footage for 1956, while a record for Cuba, was but approximately 28,000 feet more than during the previous year. During the first four months of 1957, footage drilled was lower than in the same period of either of the two previous years. In January, 1957, 18,793 feet were drilled; in February, 11,935 feet; in March, 21,478 feet; and in April, 18,960 feet.

Thus, if drilling during the last eight months of this year proceeds at the same rate per month as the first four months, the footage figure for 1957 should reach 213,498 feet.

At the same time, The Atlantic Refining Company of Cuba, Cuban American Drilling and Exploration Company, Cuban Kewanee Oil Company, United Cuban Oil Inc. and Siboney-Caribbean Petroleum Company either had announced or were working on plans for extensive

Wildcat Drilling in Cuba

PROVINCE	Wildcats Drilling at Dec. 31, 1956	No. of Wildcats Drilled During 1956 and Results			
		Oil	Gas	Dry	Total
Oriente	1	0	0	3	3
Camaguey	0	1*	0	10	11
Las Villas	3	0	0	14	14
Matanzas	0	0	0	5	5
Havana	4	0	0	3	3
Pinar del Rio	1	0	0	6	6
Total	9	1	0	41	42

* Catalina 1 Discovery well.

Development Drilling in Cuba

FIELD	No. of Field Wells Completed During 1956 and Results				No. of Field Wells Drilling at Dec. 31, 1956	Amount of Footage Drilled During 1956 (in Feet)
	Oil	Gas	Dry	Total		
Bacuranao-Cruz Verde	6	0	5	11	5	.....
Motembo	12*	0	12	24	4	.....
Jarahueca	0	0	3	3	0	.....
Jatibonico	4	0	4	8	0	.....
Santa Maria del Mar	4	0	8	12	2	.....
Catalina	1	0	0	1	2	.....
Total	27	0	32	59	13	278,515

* All produce naphtha.

Cuba Oil Production

FIELD	1956 Crude Production		1955 Crude Production		No. of Crude Producing Wells End of 1956		Province	Type	No. of Wells Shut In as of Dec. 31, 1956
	Daily Average	Year's Total	Daily Average	Year's Total	Flowing	Artificial Lift			
*Bacuranao-Cruz Verde	180	65,768	....	.....	0	10	Havana	Crude	0
Motembo	17	6,276	17	6,235	0	200†	Las Villas	Natural Naphtha	0
Jarahueca	87	31,991	150	54,800	0	6	Las Villas	Crude	0
Jatibonico	1,075	393,436	817	299,360	0	26	Camaguey	Crude	0
*Santa Maria del Mar	122	44,802	....	.....	0	4	Havana	Crude	0
Catalina	2	848	0	0	0	1	Camaguey	Crude	1
*Havana	....	.....	58	21,429	....	...	.....	.....	..
Total	1,483	543,121	1,042	382,824	0	247	.....	.....	1

* Bacuranao-Cruz Verde field and Santa Maria del Mar production listed under "Havana" in 1955.
† These wells are bailed with winch and bailer. They are stripper wells, producing generally only a few gallons or barrels a month.

drilling programs during the last half of this year.

Therefore, it appeared likely that footage drilled in 1957 would be at least 200,000 feet and could top 300,000 feet. In January, 1957, 9 rotaries and 13 cable tool rigs were active. In February, March and April, the active rotary and cable tool rigs were 8 and 14, 9 and 15, and 8 and 12, respectively.

Exploration. A study made by CPND on estimated expenditures and commitments for exploration and drilling in Cuba for the years 1952 to 1956 showed that actual expenditures were about $250,000 in 1952, $500,000 in 1953, $750,000 in 1954, $3 million in 1955, and $12 million in 1956.

Drilling commitments and exploration obligations were estimated at $500,000 in 1952, $750,000 in 1953, $3 million in 1954, $15 million in 1955, and $40 million in 1956.

The year 1956 saw the consolidation of most Cuban acreage into the hands of a relatively small number of companies. It appeared probable that there would be an increase both in funds committed for expenditures and commitments for exploration during 1957.

In January, 1956, seven geophysical crews were working in Cuba. By mid-year, one more had been added, and from August to December, the number dropped to six. During the first two months of 1957, five crews were in the field; in March, 6, and in April, 4. It appeared likely that an average of about 5 crews would be in operation during the remainder of the year.

New Field Outlook. Only one oil field was discovered in 1956. Cuban American Drilling and Exploration Company's Catalina 1 found the first deep production in Cuban history when it began flowing about 30 barrels of oil daily of clean pipe line oil of 32.9 gravity from 7102-7120 feet. The well was located about two miles south of the town of Jatibonico and two miles north of La Catalina in Camaguey province.

Discovery of the Catalina field brought to six the number of producing fields in 1956. They were Bacuranao-Cruz Verde, Santa Maria del Mar, Jarahueca, Jatibonico, and Catalina oil fields and Motembo naphtha field.

Juanita 1 well drilled by United Cuban Oil Company in the Cuadreny Primero concession near Guanabo was classified by some oilmen as a discovery well in June, 1956. However, difficulties were encountered with production, and the well was not listed as a producer until January, 1957.

Including the Guanabo field, which now has two wells producing about 25-30 barrels of oil daily combined, as a new field, brought this year the number of currently producing fields to seven at mid-year.

Refining. Work was begun last year by The Texas Company (West Indies) Ltd. on a 20,000-barrel-a-day refinery in Santiago de Cuba; by Esso Standard Oil, S. A., on a 35,000 barrel daily refinery (Belot) near Havana, and by Compañia Petrolera Shell de Cuba, S.A. on a 28,500 barrel per day plant near Havana.

While it had been hoped that both the Texas and Shell plants would be completed during 1956, the Shell plant was the only one to go on stream during the year—in December, for a test run. It began production in early 1957.

The Texas Company expected to have its refinery completed in mid-1957, and the Esso plant was expected to be completed by year's end.

The 2000-barrel daily Cabaiguan refinery in Cabaiguan, Las Villas province, and the 200 barrel-a-day Bacuranao topping plant are the only other refineries in Cuba.

Copetrol Oil Refining Company of Cuba announced plans to build a 10,000 to 15,000 barrel-daily refinery in either Nuevitas or Cardenas, on the north coast of the island.

Existing refining capacity amounts to 40,100 barrels a day, an increase of 29,200 barrels from the previous year. The scheduled expansions will raise Cuba's refining capacity to 85,600 barrels daily.

With the establishment of three large modern refineries in Cuba, it appeared likely that considerably increased stocks of crude would be imported for refining. The finished products then will be sold in Cuba and abroad with Shell, Esso and Texaco planning to service some of their Caribbean markets from the new plants in production or building in Cuba.

Economy. Cuban economy continued to expand during 1956 with the industrialization and diversification program of the present government bringing many new industries to the island. Building of secondary and farm-to-market roads has increased transportation facilities. Good sugar sales and high income from custom's duties put the country's economy in a very favorable condition last year, and these trends have continued in 1957.

Continuing political attacks on the present government have had little effect on the economic life of the country, except that some private foreign capital investments had been discouraged to some extent.

Trinidad . . . Continuing exploratory efforts pay off with 16.2 percent production increase.

CONTINUING EMPHASIS ON efforts in Trinidad to discover new oil and to increase crude production has led to another banner year for the island's oil industry. Crude output during 1956 amounted to 28,928,800 barrels for a daily average yield of 79,000 barrels. This was tantamount to a 16.2 percent increase from 1955's production of 24,895,700 barrels for the year, or a daily average of about 68,200 barrels.

Sizable increases also were recorded in 1956 in the number of well completions, the number of new oil or gas producers and in the amount of footage drilled. Although the average number of rigs operating in 1956—27—was the same as in the previous year, 262 wells were completed last year, 14.9 percent, or 34 wells, more than the 1955 completions which totaled 228.

Footage drilled last year in Trinidad amounted to 1,110,745 feet, 123,178 feet more than the 987,567 feet drilled during the previous year. This upturn amounted to 12.5 percent. The year 1956 further outstripped the

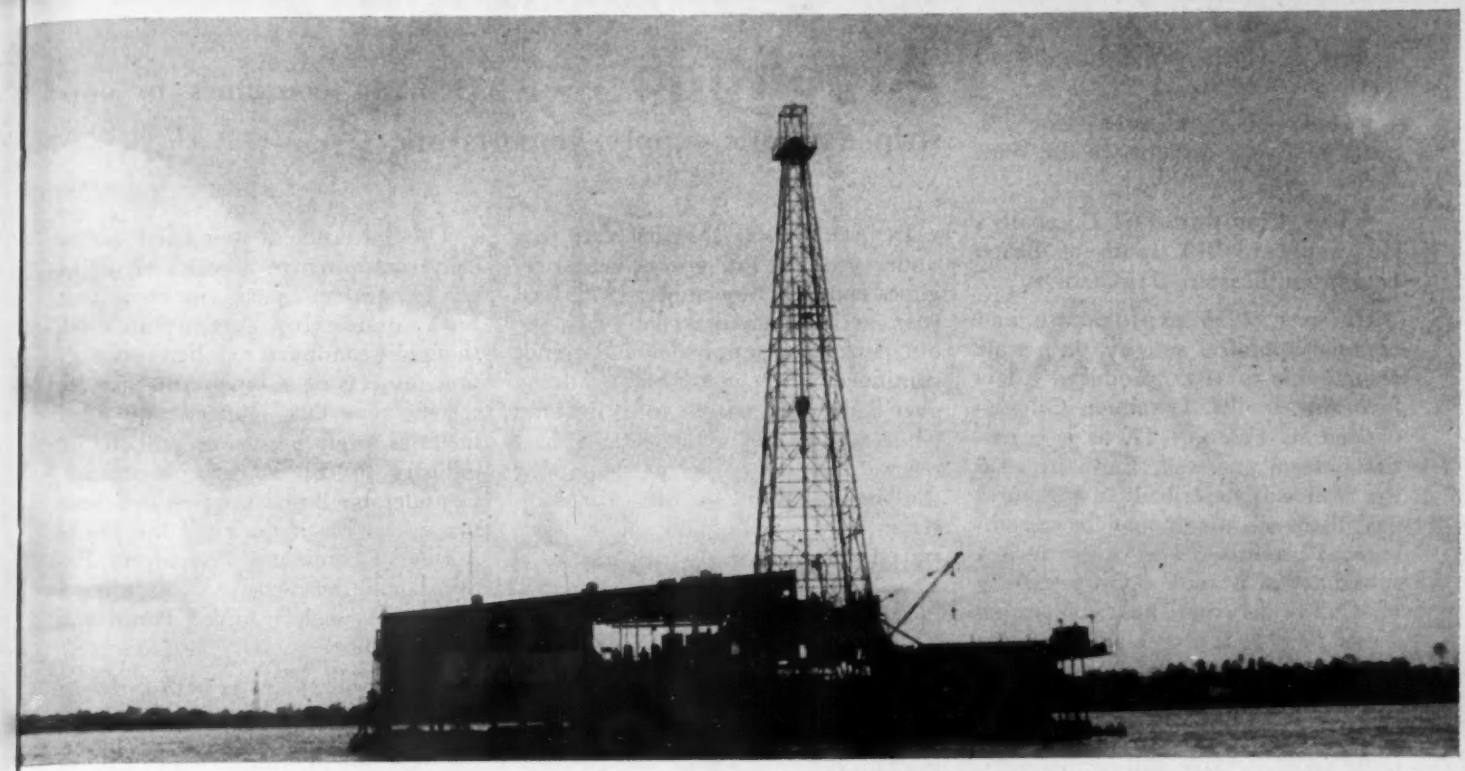


Photo courtesy The Texas Company

This drilling barge, towed from Texas, is located a half mile off Pointe-a-Pierre, which is 12 miles from Brighton, Trinidad. It is being operated by a subsidiary of McColl-Frontenac Oil Company Limited of Canada.

1955 industrial pace in the number of new oil and/or natural gas wells, with 228, as compared with 196 recorded in 1955—a rise of 16.3 percent. The drilling success ratio thus climbed from 86 percent in 1955 to 87 percent last year.

Twenty-three wells were drilling and 1824 wells were shut in as of Dec. 31, 1956. During that month, 2924 wells were producing.

During the first half of 1957, four regional appraisal tests were under way:

- The Antilles Petroleum Company (Trinidad) Limited test, AT-3, which was being drilled in the Ortoire.
- The Trinidad Petroleum Development Company Limited well,

Drilling in Trinidad

(All Companies)

TYPE	WELLS COMPLETED IN 1956					WELLS COMPLETED IN 1955				
	Oil	Gas	Dry	Total	Percent Successful	Oil	Gas	Dry	Total	Percent Successful*
Exploratory Tests	2	1	19	22	13.6	2	3	5	10	50.0
Development Wells	223	2	15	240	93.3	188	3	27	218	87.6
Total	225	3	34	262	87.0	190	6	32	228	86.0

* Wells which discovered oil and/or gas are not necessarily commercial producers.

Oil and Natural Gas Production in Trinidad

COMPANY	CRUDE OIL PRODUCTION (In Barrels)			NATURAL GAS PRODUCTION (In Mmcf)	
	1956	1955	Cumulative Through 1956	1956	1955
Antilles Petroleum Company, Ltd.	2,432,678	1,298,637	15,553,856	3,343	2,201
Apex (Trinidad) Oilfields, Ltd.	2,982,825	3,005,101	108,191,392	4,128	3,931
Dominion Oil, Ltd.	.....	.....	.....	....	....
Kern Trinidad Oilfields, Ltd.	1,093,588	964,799	20,404,131	544	456
Premier Consolidated Oilfields, Ltd.	410,740	365,615	n.a.	39	33
Siparia Trinidad Oilfields, Ltd.	1,531,141	826,792	n.a.	2,076	880
The Trinidad Oil Company[1]	6,853,098	6,464,290	195,066,252	13,594	10,710
Trinidad Northern Areas, Ltd.	642,632	438,703	1,214,980	924	523
Trinidad Central Oilfields, Ltd.	1,557,764	1,465,134	n.a.	5,209	4,400
Trinidad Petroleum Development Company, Ltd.	4,147,158	3,522,143	62,865,063	8,453	6,789
Shell Trinidad, Ltd.[2]	7,277,144	6,544,501	123,754,460	13,430	10,849
Total	28,928,768	24,895,715	527,050,134	51,740	40,772

[1] Formerly known as Trinidad Leaseholds, Ltd.
[2] Formerly known as The United British Oilfields of Trinidad, Ltd.

Important 1956 Discoveries in Trinidad

OPERATOR	Well Name	Well Location	Basis for Location	Completion Date	Total Depth of Well (Feet)	Producing Depth (Feet)	Initial Production (Barrels/Day)	Gravity	Producing Formation (Name and Age)	Deepest Formation Tested	Name of Field or Pool	Exploratory Class	REMARKS
Antilles Petroleum Co. (Trinidad), Ltd.	AS-58	Brighton	Subsurface Geology	Dec.	7468	6047–6998	591	29.1	Lower Narivas	Nariva	Brighton Marine	Extension	Directional well bottomed 6500 feet north of Brighton. Extends field 3000 feet north.
Dominion Oil, Ltd.	Freeport 1A	N.C. Trinidad	Seismic	March	9197	5900	....	....	Springvale U. Miocene	Brasso Oligocene	Freeport	New Field	Well suspended
Shell Trinidad, Ltd.*	IN-2A	S.C. Trinidad	Surface and Subsurface geology	Oct.	Information not yet released		349	33.5	Not yet released		Inniss	Regional Appraisal	.....

* Formerly known as The United British Oilfields of Trinidad, Ltd.

Cedros 7, which was drilling ahead on the south coast.

• Dominion Oil Limited's Couca 2, north of Pointe-a-Pierre on the West Coast.

• The Trinidad Oil Company's Guayaguayare 219, south of Beach field in southeastern Trinidad.

However, 1956 exploration and regional appraisal activity, on a scale comparable to 1955, produced a few favorable results. Dominion Oil suspended its Freeport 1A as a potential natural gas well. Early in 1956 the well was described as a natural gas discovery which may be a commercial producer. The company is a subsidiary of Standard Oil Company of California, and has exploration rights in the central part of the island's north basin.

The Trinidad Northern Areas, Limited, completed two deviated wells from its Soldado marine platform, and Shell Trinidad, Limited, successfully completed in October its Innis-2A in the Ortoire area. The latter was drilled as a regional appraisal test, and found initial daily production of 349 barrels of 33.5 gravity crude.

A total of three producing wells now have been completed at Solado, in the Gulf of Paria, one of which is a dual producer. Drilling has commenced from a new platform located a short distance north of Solado.

The new Innis discovery is near the expanding Cats Hill in southeastern Trinidad. Several fields have been found in this region during the past five years, greatly enlarging the area under exploration in Trinidad. The region is a vast uninhabited tropical jungle, which could contribute much to Trinidad's oil industry.

Apex (Trinidad) Oilfields Limited completed two deep tests, Well Cedros 1/593 in the Erin peninsula and Well 604 in the Fyzabad/Siparia area, which reached 12,872 feet and 12,110 feet respectively, at which depths they were abandoned.

The Antilles Petroleum Company successfully extended its Brighton field with a directionally drilled onshore well. The well, with a total depth of 7468 feet, found offshore production at the 6047-6998-foot interval. Initial production amounted to 591 barrels a day of 29.1 gravity crude from the Lower Narivas. Antilles Petroleum also conducted marine drilling in shallow waters off Pointe Ligoure with a Southeastern Drilling Company barge during 1956. This barge was taken over by Trinidad Northern Areas, Limited, toward the end of the year for two near shore marine wells at Point Fortin. The barge was then released and had returned to the U. S.

While no major constructional activity or changes in lease distribution occurred during 1956, several changes in company ownership or name were announced.

• The Trinidad Oil Company, formerly known as Trinidad Leaseholds Limited, was purchased by The Texas Company.

• The British Petroleum Company, Limited, acquired a controlling interest in the Trinidad Petroleum Development Company, Ltd.

• Shell Trinidad, Ltd., formerly was known as The United British Oilfields of Trinidad, Ltd., the name having been changed to identify the company more closely with the Royal Dutch/Shell Group.

The three main refineries operating in Trinidad and owned by The Trinidad Oil Company, Ltd., at Pointe-a-Pierre; Shell Trinidad, Ltd., at Point Fortin; and Brighton Terminal, Ltd., at Brighton have an aggregate processing capacity of approximately 135,000 barrels per day. Total crude runs to stills amounted to 44.9 million barrels in 1956, or an average daily rate of 123,000 barrels.

Argentina . . . Demand continues to outstrip domestic supply; imports up.

In Argentina, the first full year under post-Peron governmental regimes ended in September, 1956. Last year, as in previous recent years, the old petroleum supply-demand trends continued, with the nation adding over 3.5 million barrels to its demand while adding only about 800,000 barrels to its indigenous crude supply, thus increasing oil imports. Large reserves of crude in remote inland areas stayed shut in.

The government remained politically committed to a policy of allowing no new concessions to private firms to develop Argentina's oil, though it continued to solicit construction projects on a long-term basis for specific pipe line, refinery, and other facilities sorely needed to pull the oil industry up by its own bootstraps. Considerable initial progress had been made, but the majority of the job of putting Yacimientos Petroliferos Fiscales on a businesslike basis after a decade of neglect under Peron was still to be done.

Production in Argentina during 1956 advanced slightly to 31,717,305 barrels, for an average of 86,659 barrels of oil daily. This represented a 3016 barrels per day increase over the 1955 rate, for a 3.61 percent rise last year. YPF, the government oil agency, produced 26,124,475 barrels for a daily average of 71,378 barrels during the year, compared to 70,087 barrels daily in 1955. Diadema Argentina S. A. de Petroleo, a Royal Dutch Shell Group member operating Kilometro 27 Field in the Comodoro Rivadavia area produced 3,055,446 barrels, an average of 8348 barrels per day. Diadema's concession was granted prior to the 1935 Argentine law which forbade, as of that year, any new concessions being granted to private firms.

Diadema and YPF produced 92 percent of the Argentine crude oil yield in 1956. The remaining 2,537,384 barrels were produced by two Argentine firms, Astra Compania Argentina de Petroleo, and Compania Rio Autel "El Sosneado," by Petroquinica, a government entity operating separately from YPF, and a Standard Oil Company (New Jersey) affiliate, Esso Productora de Petroleo, S. A. In 1955, Astra produced 970,969 barrels, Petroquinica 583,593 barrels, Esso 342,561 barrels, and "El Sosneado" 3522 barrels. Details of 1956 production by YPF and Diadema are found in accompanying tables.

Total footage drilled in Argentina during 1956 was put at 1,673,000 feet. YPF completed 272 wells last year, including 212 producers, improving

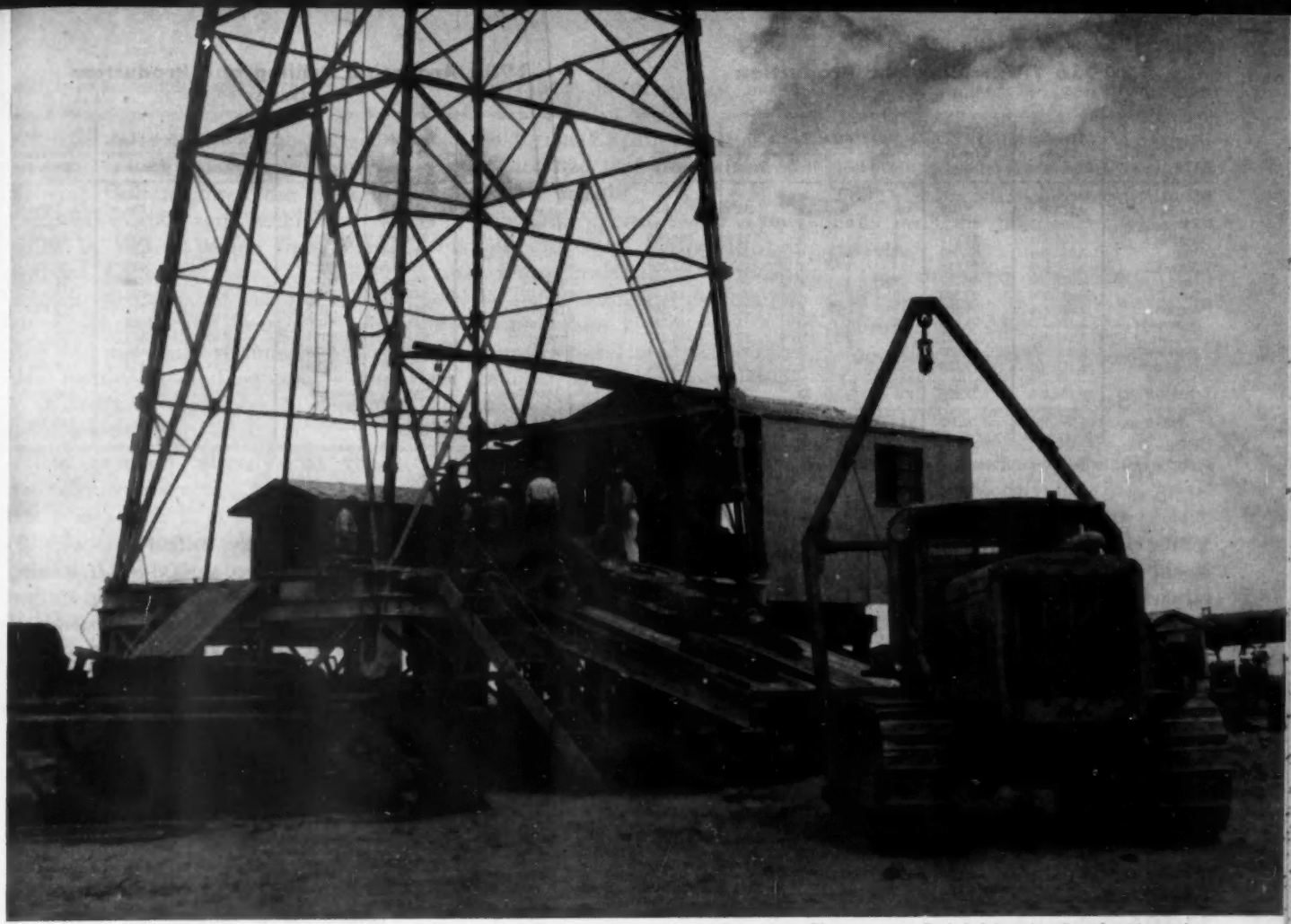


Photo courtesy Sociedad Anonima Petrolera Argentina

This rigging-up operation by Yacimientos Petroliferos Fiscales was a further indication of Argentina's efforts to continue its development drilling program. This well was drilled in Argentina's Neuquen oil field, the nation's third largest producing area.

both on 1955's record and that of 1954, when 242 wells were completed. YPF had 56 rigs in operation at the start of the year in 1956. At the end of the year, 61 wells were being drilled in Argentina.

Diadema drilled 105,363 feet of hole at Kilometro 27 in 1956, as compared with 125,509 feet during the previous year. A total of 26 wells were completed, including 15 oil wells and 11 dry holes. One well was being drilled at the end of the year. Production at Km 27 is from Cretaceous beds at 3400 and 6900 feet. Total cumulative production from this field at the end of last year was 93,199,733 barrels. On December 31, there were 435 oil wells on pump and two were flowing.

Early in 1957 it was learned that Esso intends to close its main Salta camp. Production has dropped to 500 barrels per day and the field there is expected to last only about 6½ years longer. The company was still running one rig in Neuquen, and will continue to maintain its facilities at Lomitas, San Pedro, and Vespucio.

Exploration. YPF has continued, and now is accelerating, its exploration pragram. Reportedly, it has maintained seven surface geological parties, three gravity crews, and 11 seismic parties in the field during the past several years. Exploratory drilling has resulted in the discovery of new oil fields at Candon Ferrari and Colonia Sarmiento in Chubut; Canadon Algarobo, Nueva Provincia, and Tres Lagunas in Patagonia; Esta del Medio, Cerro Lotena, Sierra Barrosa in Neuquen; and, in 1957, at Cuyo in Salta. Other recent oil finds reported by YPF are at La Ventana, in Mendoza; El Sauce, in Plaza Huincol; and Pico Truncada, in Santa Cruz.

On March 21, 1956, the Argentine Minister of Industry announced a $250 million expenditure plan intended to raise YPF's oil production from 25 million to 62.8 million barrels annually within three years. YPF circularized 140 firms, including virtually all U. S., European, and Japanese equipment manufactures, outlining its needs.

Among the many items and projects, large and small, YPF planned to build the following:

- A $76 million, 1000-mile 24-inch gas pipe line from Campo Duran field in the far northwest near the Bolivian border to Buenos Aires.
- A $19 million, 800-mile oil line from Campo Duran to the San Lorenzo refinery, near Rosario.
- $15 million expansion of the Lujan refinery, near Buenos Aires.
- A new $18 million Buenos Aires refinery.

Several rounds of bidding and rebidding have been made, with a number of international companies showing interest in such construction, but few willing to build under the long-term credit terms YPF requires.

1956 YPF Drilling and Production
(IN BARRELS)

DATE	Monthly Crude Production	Barrels Daily	WELL COMPLETIONS Oil	Gas	Dry	Total	Footage Drilled
1956:							
January	2,233,314	72,042	17	2	4	23	101,041
February	2,065,415	71,221	14	0	5	19	93,159
March	2,120,931	68,417	16	3	2	21	128,063
April	2,042,684	68,089	21	1	6	28	118,219
May	2,170,503	70,016	12	1	2	15	155,062
June	2,077,109	69,237	21	1	4	26	118,923
July	2,083,292	67,203	16	2	4	22	144,149
August	2,213,445	71,401	15	1	6	22	118,866
September	2,159,287	71,976	23	1	0	24	146,257
October	2,241,064	72,292	22	2	3	27	143,277
November	2,248,807	74,960	16	2	5	23	172,144
December	2,468,624	79,633	19	1	2	22	129,634
1956 Total	26,124,475	71,378	212	17	43	272	1,568,794
1955 Total	25,581,731	70,087	168	9	51	228	1,348,731

* Furnished by Yacimientos Petroliferos Fiscales, the government oil agency.

1956 Argentina Drilling and Production
(IN BARRELS)

DATE	Monthly Crude Production	Barrels Per Day	PRODUCING WELLS Flowing	Pumping	Footage Drilled
1956:					
January	269,612	8,697	2	439	7,230
February	248,900	8,582	2	440	7,653
March	270,587	8,729	2	438	10,489
April	255,888	8,527	1	437	6,940
May	255,668	8,247	1	438	4,935
June	245,214	8,171	1	433	11,648
July	243,724	7,862	1	434	8,711
August	245,730	7,927	1	435	12,855
September	241,264	8,040	1	434	5,112
October	251,743	8,121	1	436	10,330
November	253,246	8,439	2	436	11,057
December	273,870	8,835	2	435	8,409
1956 Total	3,055,446	8,348	..	....	105,369
1955 Total	3,022,721	8,722	..	....	125,509

YPF's cash reserves are low and there is stiff competition for available capital virtually all over the world.

Pipe Lines. Though the pipe line picture changes somewhat with each new round of bidding, YPF has built and is operating a new 12¾-inch, 91-mile crude line from Campo Duran in Salta to Pichanal. From there, crude is loaded into railway tank cars, shipped to Formosa and thence barged down the Parana River to the San Lorenzo refinery. Capacity of the Campo Duran-Pichanal line is about 22,000 barrels per day.

YPF will build a 12¾-inch line from Pichanal to San Miguel-Tucuman, a distance of 281 miles. The pipe was purchased from Mannesmann and was in Argentina by mid-1957.

YPF has proposed a further extension of this system to carry Campo Duran crude to Rosario, via Cordoba. The line may be telescoped, possibly to 10¾-inch at the Rosario end. It would carry 22,000 barrels per day initially, with capacity to be boosted to 53,000 barrels later.

Also proposed is a 625-mile oil pipe line, likely 12¾-inch, from Mendoza to Buenos Aires, with initial capacity of 20,000 barrels daily.

A consortium of international companies, led by Williams Brothers, including Fish Engineering Company, Clark Bros. Co., and a number of West German, Belgian, and French firms, were interested in building the Campo Duran-Buenos Aires gas line.

Early in 1957, YPF bought ten new rigs capable of drilling to 6000 feet, and was trying to arrange terms for the purchase of 20 more. Shallow drilling prospects in Plaza Huincal, Comodora Rivadavia, and Tierra del Fuego were expected to be evaluated rapidly.

YPF was reported negotiating with a U. S. drilling firm regarding 40 wells projected for Tierra del Fuego, where significant production has been established on the Chilean side. In addition, YPF was negotiating the purchase of 16 new rigs capable of about 8000 feet. Its drilling rates are expected to increase greatly during 1957 and 1958.

Reserves. The official YPF estimate of crude reserves in Argentina at the end of 1956 was 882 million barrels. Qualified U. S. observers generally felt the figure was justified, though it represents a large increase from previous estimates.

The reserves of the Campo Duran field in Salta have been placed at 182 million barrels. There is about 260 to 330 feet of effective sand there below 14,000 feet. Campo Duran has been essentially drilled up, with 20 wells drilled on a 1000-meter spacing pattern. A typical well is said to flow at the rate of about 950 barrels of oil daily and about 7 Mmcf of gas. However, very expensive and extensive facilities are needed before this reserve can be fully utilized without waste. In addition to the long crude and gas lines to Buenos Aires, YPF needs a gas stabilizer, a naptha plant, and a recycling plant at Campo Duran.

Refining. Technical studies have been completed to enlarge the Lujan refinery from 13,000 to 30,000 and again to 45,000 barrels per day at a later date. Financial problems involved needed to be solved. A new Buenos Aires refinery was being studied from both standpoints.

At the end of 1956, total daily crude charging capacity in Argentina was put at 194,000 barrels. Average daily crude runs to stills during the year was 155,000 barrels.

Bolivia . . . Government's backing of new oil law highlights 1956 activities.

THE MOST SIGNIFICANT long-range development in Bolivian oil in 1956 was the government's support of the new petroleum law, considered favorable to private capital from abroad. The law was approved by Congress, and became effective Feb. 25, 1957.

Under terms of this new code, the nation was divided into four zones, with the most attractive, at latest information, being reserved for Yacimientos Petroliferos Fiscales Bolivianos, the government company. However, considerable interest was exhibited in 1956 and on into 1957 by private capital companies from abroad. During mid-1957 Bolivia was seeking bids for joint operation to develop approximately 108,000 acres of likely area adjoining the Argentine frontier.

With the new petroleum code, the following companies have become interested in acquiring concessions:

1. Bolivian Gulf Oil Company, which entered Bolivia in 1956, and

See Page 324 for a review of Bolivian oil law

which expected to begin drilling during 1957.

Under an agreement with the government, which Congress approved, Bolivian Gulf acquired the right to explore 3,750,000 acres within the reserves of YPFB. Within four years, Bolivian Gulf may select 1,125,000 acres in which it will have development rights for 40 years. Bolivian Gulf will pay the government 11 percent royalty in oil from production in the selected area, plus 19 percent development tax.

The company already has conducted aeromagnetic surveys over tracts in which it is interested.

In return for exploration rights, Bolivian Gulf was scheduled to help finance a 201-mile pipe line from Sicasica, Bolivia, to the Pacific Coast port of Arica, Chile. The U. S. company's share of the pipe line financing reportedly would be $5 million of the estimated $10.5 million required. The investment is to be amortized within eight years.

When production in the government oil fields reaches a certain level, Bolivian Gulf has an option to finance an additional pipe line from the oil fields to join the Sicasica line. The second line is estimated to cost about $35 million. It would be amortized in 12 years.

2. Shell Prospecting Co., Ltd., an affiliate of Royal Dutch/Shell Group, was the second major company to take definite interest in Bolivia since the new oil code was approved. It has been granted exploration rights on 2 million acres north of Santa Cruz and 3 million acres on the east flank of the Andes, northeast of Santa Cruz. Surface geological, geophysical and aerial survey work is planned.

3. Pure Oil Company and two associates, whose applications total 1.1 million acres.

4. Barium Steel Company, reportedly affiliated with Phillips Petroleum Company, which has applied for two blocks northwest of Santa Cruz.

5. California Exploration Company, which had filed for surface reconnaissance permits.

6. Bolivian American Oil Company, organized by Consolidated Cuban Petroleum Company had applied for 366,600 acres of exploration concessions in Zone 1.

7. Four U. S. oil and gas companies obtained an option in mid-1957 from the Bolivian government covering the approximately 900,000-acre concession formerly held by Glenn McCarthy. The four companies are Tennessee Gas Transmission Company, Union Oil and Gas Corporation of Louisiana, and Lion Oil division of Monsanto Chemical Company, all of Houston, and Murphy Corporation of El Dorado, Ark.

The same four firms also entered into a contingent contract with McCarthy individually, and with Glenn McCarthy, Inc., and Glenn McCarthy de Bolivia, S.A., to purchase all equipment they had in Bolivia, plus an assignment of all rights or claims in the old McCarthy concession.

The four firms, if the option is exercised, will pay McCarthy and his companies $1.5 million in cash, plus an additional like amount out of production payments in the future in the event oil and gas are produced and can be marketed. An undisclosed amount in advance royalties and taxes were to be paid to YPFB when the concession became effective.

Tennessee Gas, which will own 35 percent interest in the concession, will be the operator for the four companies through its newly-formed subsidiary, Chaco Petroleum, S.A.

Other companies, including The Ohio Oil Company and International Petroleum Company, Richfield Oil, and Tidewater, have sent representatives to Bolivia as observers.

Production. Bolivian crude production in 1956 rose 18.6 percent from the previous year. Total production for the past year reached 3,195,819 barrels for a daily average output of 8731 barrels. In 1955 total yield of 2,692,414 barrels was tantamount to daily average production of 7376 barrels.

This increased production trend was continuing in 1957, when, in February and March, daily average production had reached alomst 10,000 barrels.

Ninety-four percent of YPFB crude production was supplied by the Camiri and Guairuy producing areas, with Guairuy contributing about 175,000 barrels to the total volume of 2,998,016 barrels from these regions. Guairuy field is located about 15 miles south of Camiri, and is on the same structure. Average production of Camiri's 52 producing wells is almost 160 barrels per day per well.

Production of the Bermejo field, southernmost field of Bolivia located on the Argentina frontier, increased production last year to 158,215 barrels, or about 5 percent of the national total. About 30 percent of this production stemmed from the new Toro field on Bermejo's northern extension.

Sanandita field, on the large Aguarague structure, where only one well was completed, produced only 39,588 barrels. Any increase in this field's output depends upon testing of a lower horizon by deeper drilling.

Drilling. Of the 32 wells drilled in 1956, only 25 were completed. Of this number, 20 were oil producers and 5 were dry holes. In the previous year, 21 well completions resulted in 19 producers and 2 failures.

The number of active rigs increased in 1956 to 11, and total footage drilled amounted to 107,282 feet, 28 percent more than during the 1955 program. At year's end, 73 wells were producing—50 flowing and 23 on artificial lift.

Economy. The political situation in Bolivia remained uneasy. Although the government abolished the official exchange and stabilized currency so as to shift to a free economy, the economic situation remained critical.

When these difficulties can be erased, a more rapid development of Bolivia's oil potential can be expected. (See WORLD OIL, May, 1956, Page 215).

Oil Production and Drilling in Bolivia

FIELDS	CRUDE PRODUCTION		No. of Crude Producing Wells at End of 1956			WELL COMPLETIONS				
	Year 1956	Daily Average For Year 1956	Flowing	Pumping	Total	Oil	Gas	Dry	Total Wells	Total Footage
Camiri and Guairuy	2,998,016	8,191	n.a.	n.a.	52	14	0	4	18	77,068
Sanandita	39,588	108	n.a.	n.a.	12	1	0	0	1	3,497
Bermejo	158,215	432	n.a.	n.a.	9	5	0	1	6	26,717
Total	3,195,819	8,731	50	23	73	20	0	5	25	107,282

Brazil . . . Completion of pipe line results in doubling of crude production.

PETROLEO BRASILEIRO S.A. succeeded last year in more than doubling Brazil's crude production. This spectacular upturn resulted from the completion of the 31-mile crude pipe line from Catu-Mata-Candeis, affording an outlet for crude from the Reconcavo Bahiano oil fields. This pipe line has allowed oil output to increase gradually from an average of 5517 barrels per day in 1955 to almost 25,000 barrels per day at the close of 1956. Brazil's proved crude reserves were listed at 255 million barrels at mid-1957.

In January, 1956, the month's output of 218,341 barrels was furnished in the following volumes by the various fields: Itaparica, 8302 barrels; Candeias, 132,451 barrels; Dom Joao, 75,270 barrels; Paramirim, 2108 barrels; and Agua Grande, 210 barrels.

However, by December the producing trend had changed significantly. During that month, when total crude output amounted to 764,309 barrels, Lobato field furnished 153 barrels; Candeias field, 177,758 barrels; Dom Joao, 94,918 barrels; Mata de Sao Joao, 82,912 barrels; Agua Grande, 405,498 barrels; and Pojuca, 3070 barrels.

With the new pipe line connecting Agua Grande through Pojuca oil field, thence to the Mataripe refinery and on to tide water on the Isle de Mare, Agua Grande field accounts for more than 90 percent of the increase and for approximately 80 percent of total production. Late in 1956 a storage area and tanker loading facilities were completed at Isle de Mare, and the initial load of Reconcavo crude was shipped to the Santos, Sao Paulo, refinery belonging to Petrobras in September.

Drilling. With mounting crude production, Petrobras, the government's oil monopoly which in 1953 succeeded Conselho Nacional de Petroleo, was intensifying its drilling program. At the close of 1956, 20 drilling rigs were running, 9 more than were in operation at the same time of the preceding year.

In 1956, Petrobras drilled 45 wells for total footage of 229,539, for an average depth per well of slightly more than 5100 feet. No stratigraphic wells were drilled during the year.

In 1955 a total of 73 wells were drilled a total of 174,290 feet, for an average depth per well of about 2525 feet. However, 22 of the 73 wells completed were stratigraphic tests which resulted in the lower average depth per well.

Currently, Petrobras has a program to drill 1454 wells within the next four years. While Drilexco has had this account since 1938, when oil exploration in Brazil was begun, such a drilling program would likely have to be distributed among several drilling contractors.

Col. Januario Nunez, chief of Petrobras, estimated the program would cost $420 million, half of which would be financed through taxes on oil products and motor vehicles and the balance furnished by government funds.

In 1956 drilling operations in the Amazon region included:

- The Nova Olinda completion, which proved up the existence of oil.
- Spudding in of two additional Nova Olinda tests.
- Spudding in of a wildcat on the right bank of the Abacaxis River about 65 miles from Nova Olinda and preparation of additional locations.
- Completion of a well at Alter do Chao and the spudding in of another on the right bank of the Tapajos River.

In Bahia 22 wells were completed during the first five months of 1956 in the Reconcavo Bahiano area, of which 17 were oil producers, four were dry and one was drilled for secondary recovery purposes. In the Todos os Santos bay, 14 marine wells were drilled.

In the Northeast, the Riachao wildcat drilled in the Maranhao-Piaui area was completed as a dry hole, and two wildcats were drilling in the Branca e Mocambo area. In addition, drilling was scheduled to be conducted this year in the Macau sedimentary basin.

In Parana's Candido de Abreu sedimentary basin, a 9200-foot test was spudded.

Exploration. In mid-1956 nine geologic parties were in the field—two in the Amazon basin, one in Rio Maues, one in Rio Urubu, two in Bahia and three in Parana.

Natural Gas. Natural gas production of the Reconcavo Bahiano fields to the end of April, 1956, amounted to 7.7 billion cubic feet of which 243 Mmcf was produced in 1955. This gas is used for the Mataripe refinery, the cement plant at Aratu, the electric power plants at Cotegipe, and three small industrial establishments.

Refining. The output of oil products in Brazil's refineries has increased notably. Consumption is on the order of 180,000 barrels daily, and domestic refineries supply 53 percent of this volume.

Brazil Crude Production and Drilling in 1956

1956 by Month	Crude Oil Production	Barrels Per Day	Wells Spudded In	WELLS COMPLETED					Footage	Wells Producing		Rigs Active
				Oil	Gas	Dry	Stratigraphic	Total		Oil	Gas	
January	218,341	7,043	6	3	0	2	0	5	26,982	299	34	12
February	220,922	7,809	3	5	0	0	0	5	15,850	304	34	10
March	213,195	6,877	6	2	0	2	0	4	17,288	306	34	12
April	201,329	6,711	6	3	0	1	0	4	23,426	309	34	14
May	202,012	6,516	3	3	0	1	0	4	15,568	312	34	13
June	170,091	5,670	5	2	0	1	0	3	20,877	314	34	15
July	239,771	7,735	2	4	0	1	0	5	14,646	318	34	12
August	322,674	10,409	5	1	0	0	0	1	15,667	319	34	16
September	348,065	11,602	2	5	0	0	0	5	18,193	324	34	13
October	607,638	19,601	7	2	0	0	0	2	19,597	326	34	18
November	550,356	18,345	4	0	0	2	0	2	20,929	326	34	20
December	764,309	24,655	4	2	1	2	0	5	20,519	328*	35	19
	4,058,703	11,089	53	32	1	12	0	45	229,539	...	..	..
1955 Total	2,013,705	5,517	68	33	4	14	22	73	174,290	296	34	11

* Of 328 wells capable of producing, records showed only 127 on production. Of the 127, 38 were flowing and 89 were being produced by means of artificial lift.

Improvements scheduled include the enlargement of the Mataripe plant to 37,000 barrels daily and the proposed erection at Cubatao of a petrochemical plant to produce ethylene, ethane and propane.

Demand. There is every indication that the nation's energy demand will expand at an increasing rate. Modernization of domestic railways is being accelerated as many lines have begun reverting to diesel engines. By mid-1957 it was expected that some of the 27 diesel electric locomotives recently purchased would be in use. A recent Export-Import Bank loan of $25 million allowed one federally-owned railroad to import 45 diesel electric locomotives. Meanwhile, the bank had promised $100 million more to the federal roads for additional railroad equipment, including 231 diesels.

Brazil also is in the midst of an auto-truck boom, with numerous manufacturers setting up plans for furnishing vehicles to meet the spiraling demand.

In addition to the transportation boom, two new power stations are scheduled to begin operating in 1958 in Sao Paulo state, with electricity being produced by four gas turbine generator plants rated at 5000 KW each and costing about $4 million. Transmission lines will carry electricity to homes and industrial plants within a 50-mile radius of each station.

Fuel for the gas turbines will be supplied by refineries at Capuava and Cubatao, Sao Paulo State, from crude originating in Bahia State and elsewhere.

Chile . . . New law favorable to private capital operations is in the making.

CHILE, AS OTHER South American countries, in 1957 was contemplating a new petroleum law designed to permit private capital operations by domestic as well as capital from abroad. In 1957 President Ibanez returned to the Chilean Congress amendments to the nation's proposed new oil code after a year's lull.

Under terms of the new law, which would restrict private capital concessions to the least prospective areas of Chile, the President would be authorized to grant oil concessions to both sources of development capital on a 50-50 net profits division basis.

See Page 326 for more about Chile's new oil law.

During 1956, Chile's oil industry, operated by the government agency Empresa Nacional del Petroleo, recorded another year of gains considered satisfactory by ENAP.

Crude Production. ENAP's oil yield last year of 3,542,031 barrels resulted in an average daily production figure of 9678 barrels—37.4 percent greater than that achieved during the previous year. In 1955, total volume produced was 2,576,897 barrels, or 7060 barrels per day.

Of the 18 separate oil pools of the Magellan field, principal 1956 producers were the Sombrero, Cullen, Chillan and Flamenco pools. Sombrero accounted last year for 951,125 barrels, or 2598 barrels daily, which amounted to almost 27 percent of the nation's total output. The Cullen pool's share of annual production was 851,795 barrels for daily average production of 2327 barrels, or 24 percent of the total. Chillan pool, with production of 517,185 barrels, or 1413 barrels per day, was credited with 15 percent of the total annual output, and Flamenco shared to the extent of 2.6 percent, with 94,460 barrels for the year.

During the first quarter of 1957, Chile's 17 producing fields had produced 976,076 barrels for daily average production of almost 11,000 barrels. In March of this year, 62 wells were listed as producers—with 56 flowing and 6 on artificial lift. In December, 1956, 58 wells were producing, of which 52 were flowing and 6 were being produced by means of artificial lift.

Drilling. Last year, ENAP completed 64 wells with total footage drilled of 410,251 feet for an average depth per well of 6410 feet. In 1955, 58 wells were completed with an average depth per well of 6719 feet—309 feet deeper than in 1956—based on total footage drilled of 389,740 feet. Thus, in 1956 total footage reflected a 5.2 percent increase from the previous year, while the number of well completions was 10.4 percent greater.

Of the 64 completions during 1956, 18 found oil, 16 were gas wells and 30 were dry holes. In 1955, 25 wells were crude producers, 8 found gas and 25 were failures.

During the first quarter of 1957, 13 completions were reported. With 114,-

Chile Crude Production and Drilling

1956 by Month	Crude Oil Production	Barrels Per Day	Fields Producing	WELLS COMPLETED				Footage	WELLS PRODUCING			RIGS ACTIVE	
				Oil	Gas	Dry	Total		Flowing	Artificial Lift	Total	Exploration	Field
January	227,780	7,348	11	3	0	1	4	23,240	n.a.	n.a.	42	0	5
February	256,102	8,831	12	2	0	1	3	32,050	n.a.	n.a.	42	1	3
March	285,789	9,219	12	1	2	1	4	14,075	n.a.	n.a.	47	2	2
April	276,076	9,203	12	1	1	1	3	30,211	n.a.	n.a.	46	2	2
May	288,608	9,310	13	1	1	4	6	43,331	n.a.	n.a.	47	2	1
June	294,242	9,808	13	0	2	4	6	32,208	39	6	45	1	2
July	308,486	9,951	13	1	1	3	5	34,459	38	6	44	1	2
August	315,394	10,174	15	2	1	0	3	26,617	39	6	45	1	3
September	308,207	10,273	18	2	3	2	7	34,161	49	6	55	1	2
October	326,520	10,533	14	4	2	1	7	44,603	50	6	56	1	3
November	318,313	10,610	15	1	1	4	6	53,954	47	6	53	3	2
December	336,514	10,855	16	0	2	7	9	41,332	52	6	58	1	0
	3,542,031	9,678	..	18	16	30*	64	410,251	..	..	..	..	..
1955 Total	2,576,897	7,060	11	25	8	25	58	389,740	..	..	..	..	..
1957 by Month:													
January	332,718	10,733	17	0	2	2	4	38,376	55	6	61	3	2
February	303,634	10,844	17	0	2	3	5	37,825	59	6	65	3	1
March	339,724	10,959	17	1	0	3	4	38,138	56	6	62	3	2

* Month not reported on completion of one dry hole.

339 feet of hole drilled, average depth per well had increased sharply to 8795 feet. Of these 13 wells, 1 found oil, 4 were gas producers and 8 were dry holes.

Meanwhile, ENAP was preparing to expand its drilling operations and to drill an exploratory test in northern Chile in the Puna de Atacama, near Pedernales. There, seepages from Jurassic beds are exposed near granite outcrops.

Proposed Code Provisions. The new oil bill provides for oil exploration concessions of 50,000 hectares (123,550 acres), with a limit of 10 blocks not exceeding 500,000 hectares (1,235,500 acres). It also calls for a 31-cent per hectare annual payment, or $15,500 for each block.

The exploration term is established in the new code at four years, with provision for a two-year extension. Minimum investment for the initial term is fixed at about 80 cents per hectare and for the extension period at $1.20 per hectare.

Development concessions would be limited to a maximum of 25,000 hectares (61,775 acres), or 50 percent of the exploration concession limit. The development term is set at 30 years, with provision for one 10-year extension. The concessionaire is obliged to start development operations during the first year to retain his concession rights. During the first five years, he must drill a minimum of about 33,000 feet for each 100,000 hectares (247,100 acres) held, and about 17,000 feet more for each 25,000 hectares (61,775 acres) held during the ensuing five years.

In addition, the proposed law provides that the concessionaire must produce after 10 years a minimum of one cubic meter (6.3 barrels) of oil annually for each hectare (2.471 acres) counted on the total extension of his concession.

Provisions of the new draft generally are similar to modern petroleum legislation, except that the minimum production clause may prove impracticable, particularly since the law reserves for ENAP the entire Magellan region from Parallel 56° to 52°—to the Argentine border. This area includes the only current prospective oil areas in the nation.

Standard Oil Company of California was reported to have applied for the northern continental part of Magallenes, adjoining Argentina, but without success. Since the remaining part of Chile offers only poor prospects, the incentives offered private capital from abroad or from domestic sources by the new draft are few.

Because of the Congressional election of 1957, discussion of the law has been postponed. The uneasy political situation and the approaching Presidential election, approval or discussion of the law in the immediate future appeared improbable.

Development of Chilean oil, therefore, will remain restricted to ENAP which, although it has progressed, still faces the fact that the domestic price of gasoline and other crude products is about four times higher than in neighboring Peru, where private enterprise is permitted to operate.

Colombia . . . Daily average crude production up 12 percent.

COLOMBIA'S DAILY AVERAGE crude production rose in 1956 by slightly more than 12 percent from the previous year. Last year's daily average output of 120,578 barrels amounted to 12,734 barrels more than the 1956 rate of 107,844 barrels per day. Total production reached 44,131,718 barrels in 1956 and 39,363,002 barrels in 1955.

This upturn resulted principally from the hike in Texas Petroleum Company's production by about 4.5 million barrels following the completion of the company's pipe line from Velasquez field in 1955.

Texas Petroleum's 8.5 million-barrel yield last year was approaching Colombian Petroleum Company's reported volume of almost 9.8 million barrels. And it surpassed Colombian Petroleum's rate early in 1957, with daily average production in March of 28,663 baarrels. In that month's domestic production of approximately 123,000 barrels per day was furnished at the following rates:

Shell Oil Company, 31 percent; Empresa Colombiana de Petroleo, the government oil company, almost 25 percent; Texas Petroleum, almost

Crude Oil Production in Colombia

COMPANY BY FIELD	Year 1956	Daily 1956	Preceding Wells End of 1956	Year 1955	Daily 1955	Cumulative Through 1956
Shell Oil Company:						
Casabe	12,064,158	32,962	367	14,702,799	40,282	n.a.
Cantagallo	882,747	2,411	9	(total)		
San Pablo	1,360,309	3,716	4			
Dificil	532,330	1,458	13			
Empresa Colombiana de Petroleos:						
De Mares	10,752,950	29,379	1,118	11,254,141	30,833	475,915,090
Colombian Petroleum Company:						
Barco	9,771,305	26,697	281	9,440,370	25,864	121,829,687
Texas Petroleum Company:						
Velasquez	8,035,245	21,955	90	3,923,163	10,748	n.a.
Tetuan	428,422	1,170	4	(total)		
Palagua	93,210	254	11			
International Petroleum Company:						
Totumal	92,786	253	3	n.a.	.....	n.a.
Aguachica	118,256	323	3			
Total	44,131,718	120,578	1,903*	39,363,002	107,844	.....

* As of mid-1957, 1930 producing wells were reported, with 180 flowing and 1750 producing by means of artificial lift.

Drilling in Colombia

COMPANY	WELLS COMPLETED IN 1956					Wells Completed in 1955	Footage Drilled in 1955
	Oil	Gas	Dry	Total	Footage		
Shell Oil Company	10	0	12	22	119,606	16	95,029
Empresa Colombiana de Petroleos	19	0	5	24	89,250	28	145,433
Colombian Petroleum Company	33	0	7	40	244,988	41	251,687
Texas Petroleum Company	36	0	6	42	284,901	26	182,655
International Petroleum Company	1	0	7	8	63,540	4	34,143
Richmond Oil Company	0	1	0	1	7,217	..	.....
Mobil Oil Company	0	0	1	1	5,977	1	13,972
Texon Company	..	..	..	..	.....	1	2,986
Total	99	1	38	138	815,479	117	725,905

23 percent; Colombian Petroleum, 21 percent; and International Petroleum Company, 0.3 percent.

Development Trend. The most important region of development in Colombia again was the Magdalena Valley, where, in the middle Magdalena Basin, Shell's Casabe, Cantagallo and San Pablo fields and the former De Mares concession of Empresa are the principal producers. Also in this region, new activity by Cities Service Oil and Forrest Oil Corporation is concentrated.

Cities Service planned to begin drilling during 1957, and Forrest Oil was conducting secondary recovery practices in the De Mares concession by water well injection.

The upper Magdalena Valley, with Texas Petroleum's fields, has been reached by the new pipe line. A new producing area—Palagua—which is an extension of the Velasquez field, was put into commercial production and yielded in 1956 almost 100,000 barrels.

Second most important among Colombia's oil provinces remained the Barco concession of Mobil Oil-Texas Colombian in northeastern Colombia near the Venezuelan frontier, where new discoveries indicated a major extension.

Significant new developments have occurred in the lower Magdalena basin and near the Caribbean coast. In the basin, the Cicuco well, about 60 miles from the coast, produced 600 barrels daily on test. The test was drilled to 8115 feet, and subsequently two more flowing producers were completed.

Near the Caribbean coast, International Petroleum's Campeche wildcat had been spudded in, and to the south—along the coast—the new joint venture concessions of John W. Mecom and Empresa are located.

The Tertiary coastal belt on the Pacific, which in the north had been tested without success by Richmond Oil's 15,539-foot Buchado wildcat, was tested in 1956 by Mobil Oil's Chagui well. The latter was found to be dry after drilling to 13,107 feet. It was located near Tumaco and the Ecuadorian boundary. No further drilling efforts were reported from this region.

In the Sinu River area, a Tertiary basin to the northeast, the former A. Guiberson concession was taken up by another independent, the Delta Colombian Oil Company.

A review of Colombian oil laws appears on Page 326.

Colombia Sun Oil Company in May this year signed an agreement for half interest in 750,000 acres of concessions covering 750,000 acres in the Sinu area. The wholly-owned subsidiary of Sun Oil Company made the contract with Mobil Oil Company de Colombia and International Petroleum, original applicants for the concessions. Sun agreed to drill two exploratory wells to a depth of 9000 feet each for its one-half interest.

Pure Oil Company of Colombia and United Carbon Company will join with Sun in fulfilling obligations agreed to in the contract. The concessions in the Sinu area are at Loma Verde, La Ceiba, Santa Lucia, Arboletes, Nicocli, Martinica, Rio Mangle and Caimar.

Finally, in the eastern Llanos region, bordering the Amazon Basin, where the new petroleum law offers particularly favorable conditions and a 40-60 split in favor of the operator, new concessions have been filed by several major companies. However, no new drilling had begun.

Drilling. Well completions in Colombia increased in 1956 to 138, of which 99 produced oil, 1 found gas and 38 were dry holes. Footage drilled amounted to 815,479 feet, about 12 percent more than during 1955. Thus, average depth of wells last year equalled 5909 feet.

Demand. Domestic requirements increased last year to about 43,000 barrels a day. About 30 percent of the national gasoline needs is imported; however, domestic supply will be improved after completion of the new 28,000-barrel-a-day International Petroleum refinery at Cartagena on the Caribbean coast. Scheduled to cost $30 million, the new plant was expected to be completed during 1957. Daily average runs to stills of existing refineries was reported at 41,500 barrels.

Pipe Lines. In March, 1956, the $3.9 million 63-mile, 6-inch and 8-inch products pipe line from Buenaventura on the Pacific to Yumbo-Cali was opened. International Petroleum and South American Gold & Platinum Company supplied substantial amounts of money for the project.

Reserves. Colombia's cumulative crude production at the close of 1956 amounted to 774 million barrels, and crude reserves were estimated at 750 million barrels. Total concession area amounts to approximately 13.5 million acres.

Development during 1956 was steady, and the political unrest—which culminated in the retirement of President Rojas Pinilla in 1957, did not affect oil development.

Paraguay . . . Activity at standstill but still considered prospective oil area.

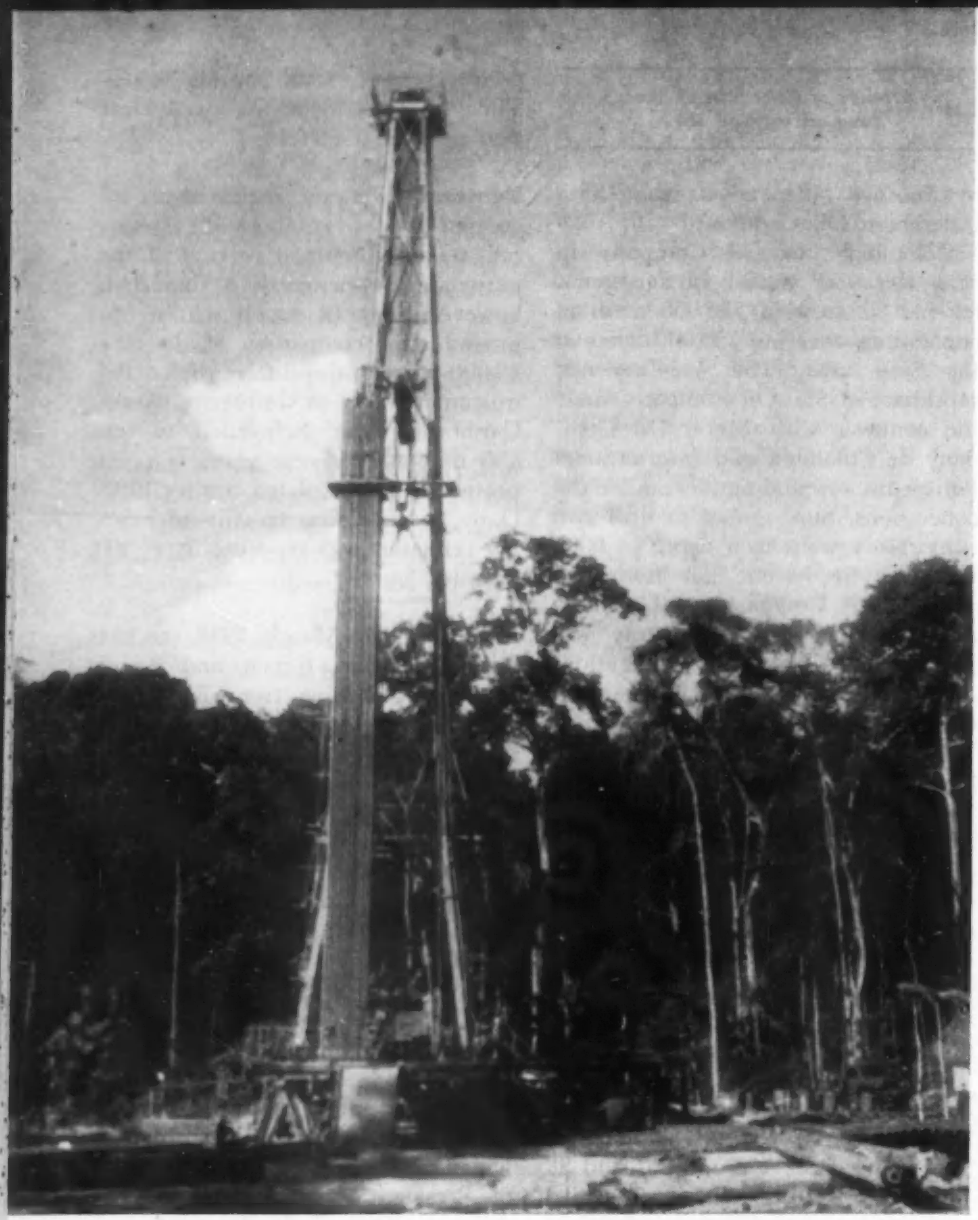
ALTHOUGH PARAGUAY PRODUCES no oil and reported no drilling or exploration activity during 1956, its territory was explored several years ago by Union Oil Company and still is believed to offer a large prospective oil area.

Paraguay is an important oil products market for Bolivian oil. Late in 1956 a commission from Bolivia, headed by Minister of Foreign Affairs Dr. Manuel Barrau, visited Asuncion, Paraguayan capital, to conclude an agreement for the construction of a pipe line to transport Bolivian oil to Paraguay and the headwaters of the Paraguay River for ultimate shipment to Argentina and, possibly, Uruguay.

An International Consortium made up of European and U. S. suppliers and contractors reportedly was negotiating with the Paraguay government on the construction of a 434-mile pipe line which would carry initially about 5000 barrels daily of Bolivian crude.

In addition to the pipe line, the consortium reportedly also would like to build a $14 million refinery in Paraguay. The pipe line was authorized under an agreement made between Paraguay and Bolivia last year.

Paraguay oil products consumption is put at approximately 1000 barrels per day.



El Oriente Company's discovery well Maquia 1 in the Peruvian Amazon Basin four miles east of Contamana produced during initial testing at a rate of 500 barrels per day of 38-gravity crude.

Peru . . . International Petroleum's purchase, oil discovery in Montaña are highlights.

Two DEVELOPMENTS highlighted petroleum activities in Peru during 1956 and the first part of 1957:

- Acquisition of a 50 percent share of Compania Petrolera Lobitos by International Petroleum Company.
- Discovery of oil in eastern Peru's Montaña.

International Petroleum's purchase of half interest in Petrolera Lobitos presaged an acceleration in the development of the Lobitos fields. The purchase price was reported at $18 million, and International Petroleum was scheduled to invest $40 million in development during the next five years. To this investment, $8 million reportedly was to be added by Lobitos Oilfields Ltd., the parent company in London.

Since Lobitos' oil fields contain considerable proved and potential crude reserves and since International Petroleum's Brea-Parinas production was being maintained largely through secondary recovery practices, the joint operation combined adequate technical personnel and financial resources to lead to an expected significant increase in the country's crude production.

Also, the acquisition marks the second important sale of British Oil properties in South America to U. S. interests. The Texas Company bought Trinidad Leaseholds Ltd. during the past year.

Discovery of oil in the Montaña was made by the national Oriente Company in association with a syndicate of three German oil companies—Deutsche Erdoel, A. G. Elwerath and Wintershall A. G. The Maquia discovery test produced at a rate of about 500 barrels of oil daily during testing operations conducted on March 10, 1957. However, it remained shut in because of the lack of transportation facilities. After almost 20 years, since the discovery in Ganso Azul in 1939, the Maquia well is the first new discovery of oil in the Peruvian Amazon basin. It was likely that this development would be one of the most significant events in the world oil industry during 1957.

Production. Peru's crude output in 1956 of 18,383,306 barrels—or a daily average yield of 50,227 barrels—amounted to an increase of almost 7 percent from the 1955 output of 17,245,534 barrels—or 47,248 barrels per day.

In the coastal area, International Petroleum maintained the producing level at Brea-Parinas, producing an average of 28,480 barrels a day as compared with 28,408 barrels a day during the previous year.

Secondary recovery practices largely were responsible for maintaining this producing level. Twenty-two wells were drilled for the waterflood program.

Including its 50 percent share in the hitherto two joint operation areas with Lobitos, International Petroleum total crude production equalled 11,557,144 barrels last year, for an overall daily average of 31,557 barrels.

Compañia Petrolera Lobitos increased its crude production by about 9 percent to a total of 5,417,649 barrels, equal to 14,802 barrels daily. Petrolera Peruana contributed from its Mirador oil field, south of the Chira River, an average of 513 barrels per day, which was delivered to neighboring International Petroleum.

By sandfracing immediately upon completion of its wells, Empresa Petrolera Fiscal improved its production considerably. In 1956, the company's crude yield reached a daily average of 2206 barrels, up 583 barrels daily from the 1955 figure of 1623 barrels. Production in March, 1957, rose to almost 2600 barrels per day.

Peruvian Pacific Petroleum Company, a subsidiary of Cities Service and Richfield Corp., last year produced a total of 137 barrels per day from its two wells.

Drilling. Petrolera Amotape, an independent which holds concessions on the northern coast adjoining Lobitos 1 area, drilled two shallow wells to the producing Upper Eocene Verdun sands, and production in March, 1957, totalled 1495 barrels.

In the Sechura, drilling activity last year was confined to Peruvian Gulf Oil Corp., which completed its first two wildcats located near the coast. Well PG 39 was abandoned in June at 4303 feet; PG 11 hit basement at 7128 feet.

The Sechura concession area was reduced substantially to a total of only about 371,900 acres at year's end, after Canadian Sea Oil, Ltd., withdrew completely.

New Bids. On the Continental Shelf, Douglas Oil Co. produced a total of 20,732 barrels from a single well, having abandoned seven others. No further activity had been reported from Douglas.

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The government opened the continental shelf for bidding at the beginning of 1957. Two national companies, Petrolera Peruana and Petroleo Sullana, in which Union Oil Company of California holds a 40 percent interest, participated in the bidding. After the auction on April 11, 1957, of the overlapping concessions—in which the highest bid reached $7 per hectare (2.471 acres), a total of 56,837 acres were granted to Petrolera Peruana and 45,837 acres to Petroleo Sullana.

Peruvian Amazon. In the Peruvian Amazon basin, the Montaña jungle, Ganso Azul increased its crude production last year to 1100 barrels a day. Production there was further increased after the Manaos refinery in Brazil went on stream in 1957. About 1500 barrels of crude were being shipped daily to the refinery.

Ganso Azul's production during the first quarter of this year fluctuated between 2000 barrels and 2500 barrels daily. Fifteen wells were producing in Agua Caliente field, and in March, 1957, Well 20 was completed at 1025 feet.

The Texas Petroleum Co., which had drilled two wildcats previously on the upper reaches and middle section of the Maranon River to 9787 feet and 9196 feet, respectively, spudded in its third wildcat on the lower Maranon River in August, 1956. In February, 1957, the test, at the mouth of the Tigre River about 75 miles southwest of Iquitos, was abandoned at 11,537 feet—the deepest well yet drilled in the Montaña.

Demand. Peru's domestic requirements of crude and products amounted to 13,814,000 barrels last year—or 37,746 barrels a day. Fuel oil imports amounted to 1,256,000 barrels, or 3400 barrels daily. The throughput of International's Talara refinery was indicated at 15,443,196 barrels, or about 42,200 barrels per day. Capacity of Peru's only other refinery, at Iquitos in the Amazon basin, is 1500 barrels per day.

Oil and Natural Gasoline Production in Peru

COMPANY	CRUDE OIL (in Barrels)				NATURAL GASOLINE (in Barrels)	
	Production For Year 1956	Daily Average For Year 1956	Production For Year 1955	Daily For Year 1955	Production For Year 1956	Production For Year 1955
International Petroleum Company	11,557,144	31,577	11,319,658	31,013	829,779	898,836
Cia. Petrolera Lobitos	5,417,649	14,802	4,964,099	13,600	184,928	175,066
Empresa Petrolera Fiscal	741,525	2,026	592,384	1,623	13,349	14,819
Cia. de Petroleo Ganso Azul Ltda.	402,807	1,101	262,413	719	.....	.....
Petrolera Peruana	187,716	513	71,529	196	.....	.....
Peruvian Pacific Petroleum Company	50,326	137	19,261	53	.....	.....
Douglas Oil Company	20,732	56	16,190	44	.....	.....
Petrolera Amotape	5,407	15	.....	.....	.....	.....
Total	18,383,306	50,227	17,245,534	47,248	1,028,056	1,088,721

Oil Producing Wells in Peru
(End of 1956)

COMPANY	Flowing	Artificial Lift	Total
International Petroleum Co.	194	1,726	1,920
Cia. Petrolera Lobitos	94	1,024	1,118
Empresa Petrolera Fiscal	14	131	145
Cia. Petroleo Ganso Azul	15	0	15
Petrolera Peruana	10	0	10
Peruvian Pacific Petroleum Co.	2	0	2
Douglas Oil Company	0	1	1
Petrolera Amotape	1	1	2
Total	330	2,883	3,213

Drilling in Peru

COMPANY	1956 WELL COMPLETIONS								WELLS COMPLETED IN 1955				
				WILDCATS			TOTAL						
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage	Oil	Gas	Dry	Total	Footage
International Petroleum Company	59	0	11	0	0	3	73	360,355	52	1	17	70	416,748
Cia. Petrolera Lobitos	60	1	11	0	0	0	72	272,703	81	0	24	105	386,597
Empresa Petrolera Fiscal	24	0	3	0	0	0	27	84,885	14	1	6	21	62,282*
Cia. Petroleo Ganso Azul	1	0	0	0	0	1	2	n.a.	0	0	3	3	3,077*
Peruana	6	0	3	0	0	0	9	41,643	4	1	0	5	n.a.
Peruvian Pacific Petroleum Company	1	0	3	0	0	0	4	38,803	1	0	3	4	25,885
Douglas Oil Company	0	0	1	0	0	0	1	n.a.	0	0	4	4	n.a.
Petrolera Amotape	2	0	0	0	0	0	2	n.a.	..	..	..	n.a.	n.a.
Texas Petroleum Company	0	0	0	0	0	4	4	n.a.	..	..	5	5	n.a.
Peruvian Gulf Oil Company	0	0	0	0	0	2	2	n.a.	..	..	..	n.a.	n.a.
El Oriente Company	0	0	0	1	0	2	3	n.a.	..	..	1	1	n.a.
International Seal Oil	0	0	0	0	0	0	0	.....	0	0	1	1	n.a.
Total	153	1	32	1	0	12	199	798,389	152	3	64	219	894,589

* Does not include wildcat footage.

Ecuador . . . Activity picks up in early '57 after general downturn in '56.

ECUADOR IN 1956 experienced a downturn in crude production, number of well completions and in footage drilled. Production of 3,394,260 barrels amounted to a daily average of 9274 barrels as compared with 3,530,622 barrels in the previous year, when the daily average yield was 9673 barrels.

However, during the first four months of 1957, the production figure reversed its trend, and the Ecuadorian oil industry was producing at a rate of more than 10,000 barrels per day. In the first quarter of this year, daily average production amounted to 1088 barrels for a total three-month figure of 97,957 barrels. In April, the daily average rose to 1198 barrels.

Drilling. This phase of the nation's oil industry also declined during 1956. During the year, 156 well completions were recorded, and footage drilled amounted to 300,739 feet. This was tantamount to an average depth per well of 1928 feet. Of these completions, 133 were oil producers, 2 found gas and 21 were dry holes. At year's end, seven rigs were engaged in field development and two were drilling wildcat tests.

In 1955, 216 wells were completed by the drilling of 332,200 feet—for an average depth per well of 1538 feet. Of the completions, 200 found oil, 1 produced gas and 15 were failures. At the end of 1955, seven rigs were engaged in development work and one was drilling an exploratory test.

During the first four months of 1957, however, the footage-drilled rate was paralleling the crude production increase. With six well completions through April, a total of 99,792 feet of hole had been drilled. Included in these completions were one oil producer and five dry holes.

Anglo-Ecuadorian Oilfields, Ltd., a British company, accounted for 1956 crude production of 2,812,902 barrels for a daily average yield of 7688 barrels. Of the 125 wells which the company had spudded in during the year, 124 had been completed at year's end. Results included 110 oil producers, 1 gas well and 13 dry holes.

Anglo-Ecuadorian's total producing wells at the close of 1956 numbered 1480. Of these, 64 were flowing wells.

The company's operations were greater during the first half of the year, when 76 of its 125 wells were begun, 70 of its 110 completions were reported, and 119,817 feet of its annual footage-drilled figure of 209,685 were recorded.

The British company's oil exports also declined in 1956 from the previous year—by 193,249 barrels. Last year, exports reached a total of 739,478 barrels as compared with 932,727 barrels during 1955.

During 1956, the Manabi Exploration Company, Inc., drilled and completed 36 wells with an aggregate footage of 77,881 feet, or 10,000 feet more than in 1955. These completions resulted in 30 oil producers and 6 dry holes. All three exploratory wells found oil, but only 27 of the 33 development wells were successful.

Manabi's development drilling was concentrated chiefly in the old Tigre "shallow" field and in the San Raimundo-Achallan fields. Wildcat wells were drilled on the company's Ahuiquimi and Cautivo concessions.

Late in December, the spudding in of Manabi's Manta 4 wildcat marked the beginning of a new era of wildcat drilling outside of the Santa Elena Peninsula, activity which had been dormant since International Petroleum Company left Ecuador in 1947. This significant Eocene-Upper Cretaceous test was located on the company's Manta concession in Manabi Province, on the coast of west-central Ecuador, and was drilling below 3000 feet at the end of the year.

In 1956 Manabi produced 581,358 barrels of crude, approximately 3650 barrels less than during 1955. Of its 170 producing wells, 32 were flowing wells and 138 were pumping.

Oil Drilling and Production in Ecuador

1956 by Month	Crude Oil Production	Barrels Per Day	WELLS COMPLETED				Footage	RIGS ACTIVE	
			Oil	Gas	Dry	Total		Field	Wildcat
January	311,182	10,038	17	1	2	20	29,335	10	1
February	286,602	9,882	20	0	0	20	36,202	10	1
March	305,541	9,856	14	0	0	14	28,330	10	1
April	258,654	8,621	14	0	1	15	23,800	10	0
May	291,089	9,389	10	0	0	10	24,758	8	0
June	281,151	9,371	10	1	3	14	29,219	9	0
July	289,336	9,333	10	0	1	11	23,432	8	0
August	286,552	9,243	9	0	1	10	18,142	8	0
September	268,639	8,954	9	0	2	11	21,351	10	0
October	276,324	8,913	9	0	5	14	25,298	8	1
November	266,242	8,874	5	0	3	8	22,159	6	2
December	272,948	8,804	6	0	3	9	18,713	7	2
Total	3,394,260	9,274	133	2	21	156*	300,739	..	..
1955 Total	3,530,622	9,673	200	1	15	216	332,200	..	..

Source: Data from Ecuador Ministry.
* Government figure is four less than the total of 160 completions reported by Anglo-Ecuadorian Oilfields, Ltd., and Manabi Exploration Company, Inc.

Denmark . . . Standard Oil negotiating for concession transfer.

NEGOTIATIONS continued during 1956 between Standard Oil Company (New Jersey) and the Danish Government toward the transfer of the Danish American Prospecting Company (DAPCO) concession from Gulf Oil to Jersey Standard interests.

DAPCO continued minimum exploration efforts to perpetuate the concession, which was granted in 1950 to Gulf Oil Corporation, DAPCO's original parent company, for 50 years, qualified on an oil discovery during the first ten years.

Two core tests were drilled early in 1956 with total footage amounting to 2150 feet. The remainder of the year was occupied with shot hole drilling preparatory to possible future seismic work. Total footage drilled for shot holes amounted to 32,300.

Switzerland . . . Some progress made; legal barriers still exist.

SOME PROGRESS TOWARD finding and developing the oil and natural gas that many geologists believe exist in the Swiss Molasse province currently is being made. The first obstacle has been a legal one, because Switzerland is composed of 25 separate states, including the cantons and semi-cantons.

According to the Swiss Federal Constitution of 1874, the mining law belongs entirely to the jurisdiction of the cantons. Until recently, none of the cantons had passed petroleum codes. Only four deep tests had been drilled in Switzerland as of 1955.

However, on Sept. 24, 1955, Cantons Zurich, St. Gallen, Argovie, and Thurgovie, in northeastern Switzerland, made an intercantonal concordat, agreeing to grant identical exploration and development concessions. At least 75 percent of the capital of the holder of any such concession must be held by Swiss nationals. The four collaborating cantons granted a concession covering all their territory to Schweizerische Erdol A G (SEAG) of St. Gallen. The company is a joint stock firm, with stock held mainly by Swiss industrial companies, and a minority interest being held by a German company, Elwerath.

See Page 344 for more about Swiss' oil laws.

In 1955, Molasse Erdolforderungs A G (MOFAG) conducted seismic work in Cantons Geneva and Ticino. This work was finished in 1956, with the company filing for an exploration permit and a proposed work program in Geneva.

SEAG's concessions in the four northeastern cantons was formally granted on March 1, 1957, for 80 years after the first oil discovery. Surface mapping began almost immediately, and by midyear 1957, $300,000 had been budgeted for seismic work in the Lake Zurich vicinity and was reported to be under way.

In mid-1956, Canton Vaud in the far southwest granted an exploration permit covering an area near the French border to S. A. Middleland Oil Company. The company had conducted some previous surface geological work. Fifty-one percent of Middleland's stock is owned by Societe Generale pour l'Industrie de Geneva.

Socony Mobil was reported to have done surface geological work in Bern Canton.

France . . . Oil laws clarified . . . domestic demand rises.

FRANCE'S OIL industry continued to advance in 1956 and 1957. Producing, refining, geophysical, and concession activities, encouraged by France's recent clarification of its oil laws and by steadily-increasing domestic demand for petroleum products, all showed gains.

Crude production in 1956 amounted to 9,102,809 barrels, for an average of 24,871 barrels per day, an increase of 42 percent over 1955's total of 6,408,508 barrels (17,558 barrels daily). In 1956, 7,377,454 barrels, or an average of 20,157 barrels a day, were produced at Esso REP's Parentis field in the Aquitaine Basin in southwestern France, near Bordeaux. Parentis now is largely drilled up, and enjoyed its first full year of normal production in 1956, when yields were boosted by 73 percent above the 1955 total.

The Aquitaine Basin continued to be, and probably will remain, the most important oil province of Metropolitan France. Societe Nationale des Petroles D'Aquitaine (SNPA) continued to get considerable oil production from the shallow zone of Lacq field, recording a total of 1,194,885 barrels of crude oil last year. This, however, represented a 28.41 percent drop from the previous year's total.

Several new fields in the narrow Rhine Graben of Alsace went on production during 1956 to give added significance to that oil province, older from the standpoint of known oil deposits and more intensively drilled. A new pay zone found in Gallacian field doubled the small amount of oil produced from 1955 to 1956 in the Languedoc Basin, which heretofore has not yielded commercial oil.

See Page 331 for more about oil laws of France.

Interest intensified in the Paris Basin, non-productive so far, and in the Rhone Valley and sub-Alpine regions of eastern France.

Esso REP. Esso REP continued its active pace in producing, wildcat and development drilling, and geophysical activities. By the end of 1956, the company had completed 22 producing wells at Parentis, which individually varied in production rates up to about 3200 barrels daily. The producers vary in total depth from 7775 feet (Number 8) to 8572 feet at Number 14. Four wells at Parentis were not producing. The crude is 33 gravity, and flows from a dolomite and limestone at the approximate Jurassic-Cretaceous boundary. There is a maximum of 1500 feet of oil column in the top of the structure. Gas-oil ratios are less than 100 to one. There appears to be an effective water drive.

Reserves of the field are put at 125 million barrels. Production in 1957 is expected to increase to about 8.7 million barrels, for an average of 23,836 barrels per day. Production was temporarily boosted to 25,725 barrels per day during December, 1956, because of the Suez crisis and resulting oil shortage in France.

Although a larger reserve figure could be justified for Parentis on the basis of proven acreage, the dolomitization of the limestone pay is erratic, occurring at the crest of the structure and plunging off structure more sharply than does the top of the limestone.

Esso Rep commenced a deep test at Parentis, Number 101, which was drilling at the end of last year. A strong flow of sulfur-free gas-condensate was encountered from the interval 12,270-12,303 feet, with an indicated bottom hole flow pressure of 8500 psi, as compared with a normal hydrostatic head of about 5600 psi for the depth. The new pay zone, found early in 1957, was thought to be lower Jurassic limestone or dolomite. It appeared likely that Parentis, like Lacq field, may have a commercial gas pay below the oil zone.

The oil zone was expected to be drilled up at Parentis by the end of this year, with a 30-well field envisioned.

Since the discovery at Parentis in

1954, three smaller oil fields have been found by Esso in the vicinity:

Mothes, a 1955 discovery, northeast of Parentis, still was a one-well field pumping about 300 barrels of 21-gravity oil daily. Dry holes have been drilled near the discovery in three directions from it. Nevertheless, in its first full year of production in 1956, Mothes was fourth among French fields producing crude oil with a total of 114,962 barrels, for a daily average of 314 barrels.

Two more fields, somewhat similar to Mothes, were brought in by Esso during the summer of 1956. At Lugos, 10 miles northwest of Parentis, and northwest from Mothes, a test bottomed at 6120 feet, was plugged back to 5480 feet, and was completed for 333 barrels of 21-gravity oil from the lower Parentis oil pay. Producing intervals at Lugos are from 4900 feet to 5450 feet in zones of highly variable porosity. Lugos field produced 37,212 barrels of crude during the relatively short time it was on production during 1956.

The other 1956 discovery by Esso was at Lucat, about 4½ miles east and slightly south of Parentis, where oil was found in September, 1956, at a depth of 6620 feet. The pay zone is in a tight limestone with rare dolomite streaks, apparently correlative with the Parentis oil horizon.

On a brief drill stem test, the Lucat test made seven barrels of 37.4-gravity crude, and was expected to produce about 200 barrels daily before acidizing. On production only briefly during 1956, the discovery yielded 1936 barrels. Production in December was 78 barrels daily—on pump.

Esso has proved one big structure at Parentis, condemned several others with deep tests, and now is proving some smaller structures as its vigorous exploration continues. It may be noteworthy that the oil gravity appears to decrease from south to north in Esso's concession area, from 37.4 at Lucat to 33 at Parentis, and to 21 at Mothes and Lugos. Much farther southeast at Lacq, the same horizon yields gas.

Heretofore, the output from Parentis has been moved to Esso Standard SAF's Port Jerome refinery near Le Havre. However, Esso SAF is planning construction of a 31,500 barrels daily refinery at Ambes, on the Gironde River 12 miles downstream from Bordeaux in southwestern France. The plant is scheduled for 1959 completion. One distillation unit and a catalytic reformer were planned. The refinery would charge Parentis crude.

SNPA. SNPA completed 42 of the 107 wells drilled in Metropolitan France during 1956. Also, the company has shallow oil production at Lacq; is developing a deep gas pay there; discovered a new oil field in the Aquitaine Basin early in 1957; and is conducting exploration in the Pyrenees, in Lorraine, and other parts of France. At the end of 1956, there were 32 wells producing oil from the shallow (2200 feet) Lacq reservoir—15 flowing and 17 pumping. Production was 3273 barrels daily at that time.

Three more deep Lacq tests found gas in the Neocomian during 1956, and SNPA continued vigorous efforts to prove up as large a gas reservoir as possible to justify the tremendous expense of putting the deep (11,200-12,000 feet), high-pressure reservoir on production. The gas is so corrosive that special alloy tubing and other expensive equipment are necessary to complete wells in Lacq Deep. Estimates of the gas reserve at Lacq Deep now vary from 5 trillion to 10 trillion cubic feet.

By midyear 1957, a desulfurization plant at Lacq to process 35 MMcf of gas daily was ready to commence operations. The plant would put about 23 Mmcf daily of dry gas into a distribution system serving domestic and industrial consumers in southwestern France. The plant was to produce about 165 tons of sulfur daily, about 260 barrels of natural gasoline per day, and about 240 barrels daily of butane and propane.

The plant was being expanded to quadruple this capacity by the end of this year, and the 1962 output was expected to be twice that of 1958.

Tying in with the new gas plant, Gaz de France, a firm organized and financed primarily by the French government to build and operate natural gas pipe lines, planned to construct a network from Lacq to Paris (about 400 miles), crossing the present St. Marcet-Toulouse-Bordeaux system, with spurs from Chateauroux to Lyon and Nantes. At Paris, the new line could be tied in with a pipe line system that provides refinery gas from Le Havre and coke-oven gas from Lorraine and the Saar to consumers in Paris. Diameters of the lines will vary from 24-inch at Lacq to 16-inch near Paris, and 10-inch at Nantes.

SNPA was drilling four deep wildcats in the Neocomian trough north of the Pyrenees at the end of 1956, including Clermont 1, which was reported drilling at 10,290 feet with good oil shows having been found. Early in 1957, Clermont 2, the second test on the flank of a diapir located about 10 miles southeast of Dax, and about 60 miles south of Parentis field, discovered oil in Albian-age (middle Cretaceous) sandstone.

An 80-minute open hole drillstem test of the 6260-6365-foot interval produced nine barrels of 35-gravity crude oil and five barrels of water. In mid-March, the operators were to run 9⅝-inch casing through this pay and drill deeper in search of the Neocomian dolomites productive at Parentis and Lacq. The indicated production would be the first in Albian, and the first in a sandstone, found in the Aquitaine Basin.

RAP. Regie Antonome des Petroles increased gas production from St. Marcet field primarily to increased demand. St. Marcet is located about 70 miles east and slightly south of Lacq in the foothills of the Pyrenees Mountains. Total gas production was 11,660,306,700 cubic feet, for a daily average of almost 32 MMcf. This represented a 20.5 percent increase over the 1955 total.

In addition, RAP produced 263,574 barrels of condensate at St. Marcet during 1956, as compared with 242,240 barrels during 1955. Including 1564 MMcf produced by SNPA at Lacq Deep in 1956, total gas production in 1956 exclusive of that produced with oil was 13,225,206,700 cubic feet. RAP also drilled nine wildcats in 1956 and was drilling a tenth at the year's end.

SPG. Societe des Petroles de la Garonne (SPG) was active in wildcat drilling during the year. RAP is in charge of drilling operations for SPG. Five dry holes were completed in 1956, north of the Pyrenees and north and east of St. Marcet.

CEP. Compagnie D'Exploration Petroliere (CEP) continued drilling and producing operations along the Mediterranean coast west and southwest of Marseille. In the Gallician field, Well 9 failed to find the non-com-

mercial shallow pay yielding slight amounts of oil in Gallician 3.

Upon deepening, however, a new pay was found that yielded 50 barrels daily during the 100 days it was on production during 1956. Gallician 9 was drilled to 8704 feet before being put on production. CEP also conducted a six-week seismic survey in the Gulf of Lyon, data from which reportedly indicated interesting submarine structures.

Rhine Graben. Intensive drilling continued in the Rhine Graben, where Societe de Prospection et Exploitations Petrolieres en Alsace (PREPA) completed 21 wells and was drilling four more at the end of 1956. Four wells were completed at Scheibenard in the far northeast near the German border. Two wells each were completed at Donau, Schirrein, Haguenau, Eschau, and Reiningue.

At Scheibenard, drilling operations along a horst resulted in production of highly paraffinic oil in Meletta beds in Scheibenard 2, thicker sands in Well 3, and a strong gas flow in Well 5. At Reiningue, small reserves of crude were developed in the Rauracian.

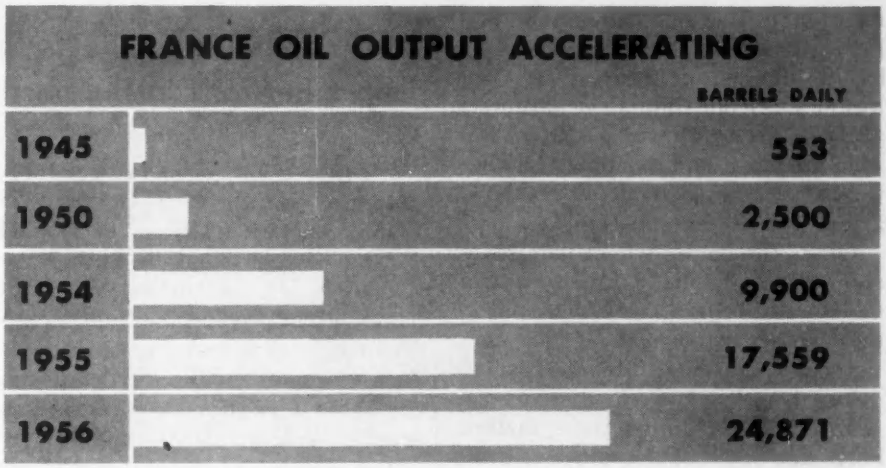
Paris Basin. Great interest has been concentrated on the Paris Basin. Two interesting tests were being drilled late in the year.

CEP drilled a wildcat to 8740 feet at Chateau-Landon, and tested a fractured middle Jurassic limestone which yielded several barrels of oil before going to salt water.

Societe France Outre-Mer de prospections et Exploitations Petrolieres (FROPEX) drilled a test on a seismic structure 16 miles southeast of Orleans. This test, known as Sennely 1, was spudded at the year's end and abandoned in March, 1957, at 7051 feet in Triassic red beds. Actual basement was not reached but it appeared that all marine strata had been penetrated. The Jurassic section was almost all marine limestone, however, with many lithologic changes.

Compagnie Francaise des Petroles (Normandie) (CFP-N) conducted both core drilling and conventional drilling in the western Paris basin, in the vicinity of Le Havre and Dieppe, with interesting but intangible results.

RAP gave up its exploration southeast of Bourg because of highly complicated structural conditions, but a well near Lons-le-Saunier flowed



Production in France in 1956*

NAME OF FIELD	Ownership	Basin	Crude Production in 1956 (Barrels)	1956 Daily Average Production (Barrels)	Crude Production in 1955 (Barrels)	1955 Daily Average Production (Barrels)	Percent Increase or Decrease, 1956
Parentis	Esso REP	Aquitaine	7,377,454	20,157	4,267,300	11,691	+72.89
Lacq (Upper Zone)	SNPA	Aquitaine	1,194,885	3,265	1,669,000	4,573	−28.41
Pechelbronn Area	Pechelbronn	Rhine Graben	234,588	641	284,000	778	−17.39
Mothes	Esso REP	Aquitaine	114,962	314	81,908	224	+40.36
Soufflenheim	PREPA	Rhine Graben	54,935	150	.....	....	.....
Donau, Schirrein, Reiningen	PREPA	Rhine Graben	41,705	114	59,000	162	−29.31
Lugos	Esso REP	Aquitaine	37,212	102	.....	....	.....
Staffelfelden	PREPA	Rhine Graben	23,623	65	44,900	123	−47.39
Eschau	PREPA	Rhine Graben	9,992	27	.....	....	.....
Hagenau, Scheibenhard	PREPA	Rhine Graben	5,849	16	.....	....	.....
Gallician	CEP	Languedoc	5,668	≈15	2,400	7	.....
Lucats	Esso REP	Aquitaine	1,936	5	.....	....	+136.17
Total	.....	.....	9,102,809	24,871	6,408,508	17,558	+42.04

* Adapted from the American Association of Petroleum Geologists Bulletin.
Note: St. Marcet, St. Jean de Marvejols, and Gabian fields, formerly oil productive, reported no oil production in 1956.

Drilling in France in 1956*

COMPANY	NUMBER OF RIGS RUNNING IN 1956				Footage Drilled in 1956 (Conventional)	Core Drill	Total Wells Completed During 1956*	Number Wells Drilling, End of 1956†
	Heavy	Medium	Light	Total				
Esso REP	3	2	0	5	161,442	0	19	4
SNPA	8	1	3	12	219,486	9,350	42	10
RAP	2	1	1	4	53,831	0	9	4
SPG	1	0	0	1	22,816	0	5	1
CEP	0	1	0	1	21,778‡	0	6	0
FROPEX	0	1	0	1	2,345	0	0	1
Petrorep	0	0	1	1	9,941	0	3	2
PREPA	0	2	2	4	77,762	0	21	4
SPV	0	1	0	1	5,503	0	0	1
CFP(N)	0	0	1	1	7,933	54,468	2	1
Total	14	9	8	31	582,837	63,818	107	28

* Adapted from AAPG Bulletin and Le Journal des Carburants.
† Excludes core drill holes.
‡ Excluding 5800 feet of hole drilled by the same company in the Sahara Desert.

Geophysical Activity, 1956*

NAME OF COMPANY	PARTY MONTHS				
	SEISMIC		Gravity	Magnetic	Telluric and Electric
	Refraction	Reflection			
SNPA	0	57.5	0	0	1.5
Esso REP	0	48	0	0	0
SPG	0	25.4	0	0	5
SPV	0	11.2	6.2	0	0
CPG	0	4	0	0	0
CFP(G)	0	5.2	5.4	0	0
R.A.P.	0	23.2	0	0	0
CEP	0	36	0	0	0
FROPEX	0	25.7	0	0	0
PREPA	0	29	0	0	0
PETROREP	0	5.4	0	0	0
SAFREP	0	11.9	6.5	0	0
SNPA	2.3	0	0	0	0
Mobiloil	0	2.5	5	0	0
Total	2.3	285	23.1	0	6.5

* Reprinted from the AAPG Bulletin.

more than 3 Mmcf of methane and hydrogen sulfide. The test was drilled by the Bureau de Recherches Geologiques, Geophysiques et Minieres (BRGGM) and flowed gas from Triassic limestone and dolomite. Another well, Savoie 108, had oil and gas shows at the base of the upper Jurassic.

Other companies whose names are abbreviated in the accompanying tables and not previously identified in the text, are as follows:

Societe Petroliere de Recherches dans La Region Parisienne (PETROREP) drilled three shallow holes east of Versailles and was drilling another at the end of 1956.

Societe des Petroles de Valence (SPV): was drilling at St. Lattier on a permit southeast of Lyon in the Rhone Valley at the end of 1956.

Compagnie des Petroles de Guyenne (CPG): was conducting seismic, gravity, and drilling operations in the Aquitaine basin, east of Esso REP's holding.

Compagnie Francaise des Petroles (Gascogne) (CFP-G): was conducting seismic and gravity work not far from CPG's operations.

Societe Francaise de Recherches et E'Exploitations de Petrole (SAFREP): was conducting gravity and seismic work in the Jura.

Mobiloil S.A.F: has permit areas in both the Paris and Aquitaine Basins.

European Pipe Lines. France would be the hub of a Western Europe crude pipe line system proposed last summer. The plan was shelved when the Suez crisis developed, since the system, which would include a large-diameter main trunk from Marseilles, on the Mediterranean Coast, to Cologne, in West Germany, with possible spurs to Strasbourg, Paris, and Rotterdam, would be predicated upon steady and reliable movement of Middle East crude to the eastern Mediterranean.

The project probably would cost about $300 million. It would make unnecessary the long tanker hauls from the western Mediterranean around the Iberian peninsula to such ports as Le Havre and Wilhelmshaven.

Refining. Despite intensive exploration and producing efforts in France, the nation still obtains only 5.6 percent of its oil from indigenous sources.

Sources of some of the data used herein are the *Bulletin of the American Association of Petroleum Geologists*, and *Le Journal des Carburants*.

Germany . . . Exploration branches out into deeper horizons in the northwest.

INTENSIVE EXPLORATION efforts, continued in Western Germany in 1956, led to the discovery of new oil and gas deposits and to further development of known fields. Some companies began probing the hitherto unexplored horizons below the huge Zechstein salt formation in Northwest Germany. This effort requires drilling depths of at least 13,000 feet.

The search for deeper pays is expensive, and continued exploration depends on whether the protection duty for German oil—and thereby the prices for indigenous oil—will be maintained. This became a problem when the agreement on the Common Market in Western Europe was signed by the Federal Republic and its neighbors. It is foreseen that after a period of six years a new uniform level of low oil duties is to be applied for all members of the Common Market. Thus, another means of protecting indigenous oil must be found, provided that the agreement on the Common Market will be ratified by the member countries.

Drilling. The extraordinarily high footage rate of 1955 was almost reached again last year. Total 1956 footage amounted to 2,322,779 feet, about 86,000 feet, or 3.6 percent, lower than in 1955. Well completions in 1956 totaled 518 wells, of which 305 development wells included 267 oil wells, 11 gas producers, and 27 dry holes. The remaining 213 wells were wildcat tests and resulted in 44 oil producers, 24 gas wells, and 145 failures.

It is significant that almost 50 percent of completions were exploratory tests. The exact breakdown of footage drilled was 634,900 feet by wildcats, 487,974 feet by extension wells, 1,133,645 feet drilled in known fields, and 66,260 feet accounted for by service wells.

To reach this level of drilling 165 rotary rigs and 105 light drilling units were used.

Production. Crude production of the Federal Republic stepped up in 1956 to 24,894,155 barrels, for a daily average of 68,203 barrels. This amounts to an 11.4 percent improvement over 1955. The upward trend continued during the first months of 1957.

This rise is due largely to the further development of producing fields such as Ruehlermoor (Emsland), Dueste (Weser-Ems district), and Hankensbuettel (Hanover), all of which were discovered after World War II. Previously, the oil districts of Emsland and Hanover dominated the production scene, but now the other oil districts are gaining in importance. Hanover's share in the total output amounted to 34.6 percent in 1956. The Emsland district fell from the 1955 figure of 35.7 percent to 33.4 percent in 1956. On the other hand, the Weser-Ems district increased by 2.3 percent to 17.0 percent in 1956. The remaining was divided between Holstein-Hamburg, 11.7 percent; Rhine Valley, 2.7 percent; and Bavaria, 0.6 percent.

The German Geological Survey's estimate of proven crude reserves was 367 million barrels at the end of 1956. In addition, a figure of 105 million barrels of probable crude reserves was published. Thus, the Association of German Crude Oil Producers' forecast for production of more than 29 million barrels for 1961 did not appear overly optimistic. At year's end, Germany had 3010 producing oil wells of which 424 were flowing and 2586 were pumping.

Natural gas production of Western Germany was stepped up considerably in 1956. With a total of 12,947 million cubic feet, the production was more than 50 percent greater than that of 1855. Largest producer was the Ruhden field near Diepholz (Weser-Ems), which provides the steel industry of Osnabrueck with heating energy. In the Emsland district, the newly-discovered Adorf gas field was developed further and linked with the pipe line system connecting the gas producing area of Emsland with the chemical factory at Huels (Ruhr district).

Pipe Lines. The outstanding pipe line industry development last year was the foundation of the Nord-West Oelleitung GmbH., which is a joint interest of leading oil companies, including the German affiliates of Standard Oil Company (New Jersey) and The

British Petroleum Company. The new company is to build the planned 220-mile, 28-inch pipe line from Wilhelmshaven harbor (North Sea Coast) to the refineries in the Rhine-Ruhr area.

The second big scale project was the projected northern section of the Sappeur pipe line system, in which Shell will participate. This will mean the building of a pipe line of about 150 miles from Rotterdam to the site of Shell's proposed Godorf refinery, south of Cologne.

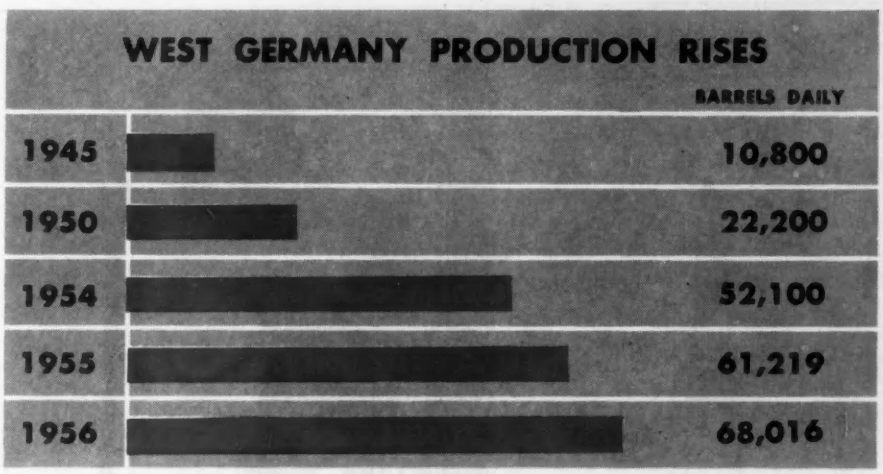
Gelsenberg Benzin AG. is building a 15¾-inch, 30-mile pipe line from the Rhine harbor of Wesel to its plant at Gelsenkirchen-Horst, which later may be connected with the Sappeur system.

At year's end, the total length of the available crude oil pipe lines, most of them linking oil fields with nearby railway stations or refineries, was 248 miles. The total length of the natural gas pipe line network was 186 miles at the end of 1956.

Refining. West Germany's refining capacity of about 300,000 barrels daily remained practically unchanged in 1956. Some refineries switched over to the production of fuel oil, a product which has found a growing market in Germany.

New Discoveries. As far as could be determined, the oil and gas deposits discovered in 1956 are of medium or minor economic value only. They include:

- In the Holstein province, near the Baltic Sea coast, the wildcat Schwedeneck 7 of Wintershall-Deutsche Erdoel-AG. This test found the main sandstone of the Dogger beta at the end of July. By pumping, the well initially yielded about 60 barrels daily from a depth of about 4920 feet. Additional completions in 1956 and 1957 resulted in a producing rate of 3500 barrels per month by April, 1957.

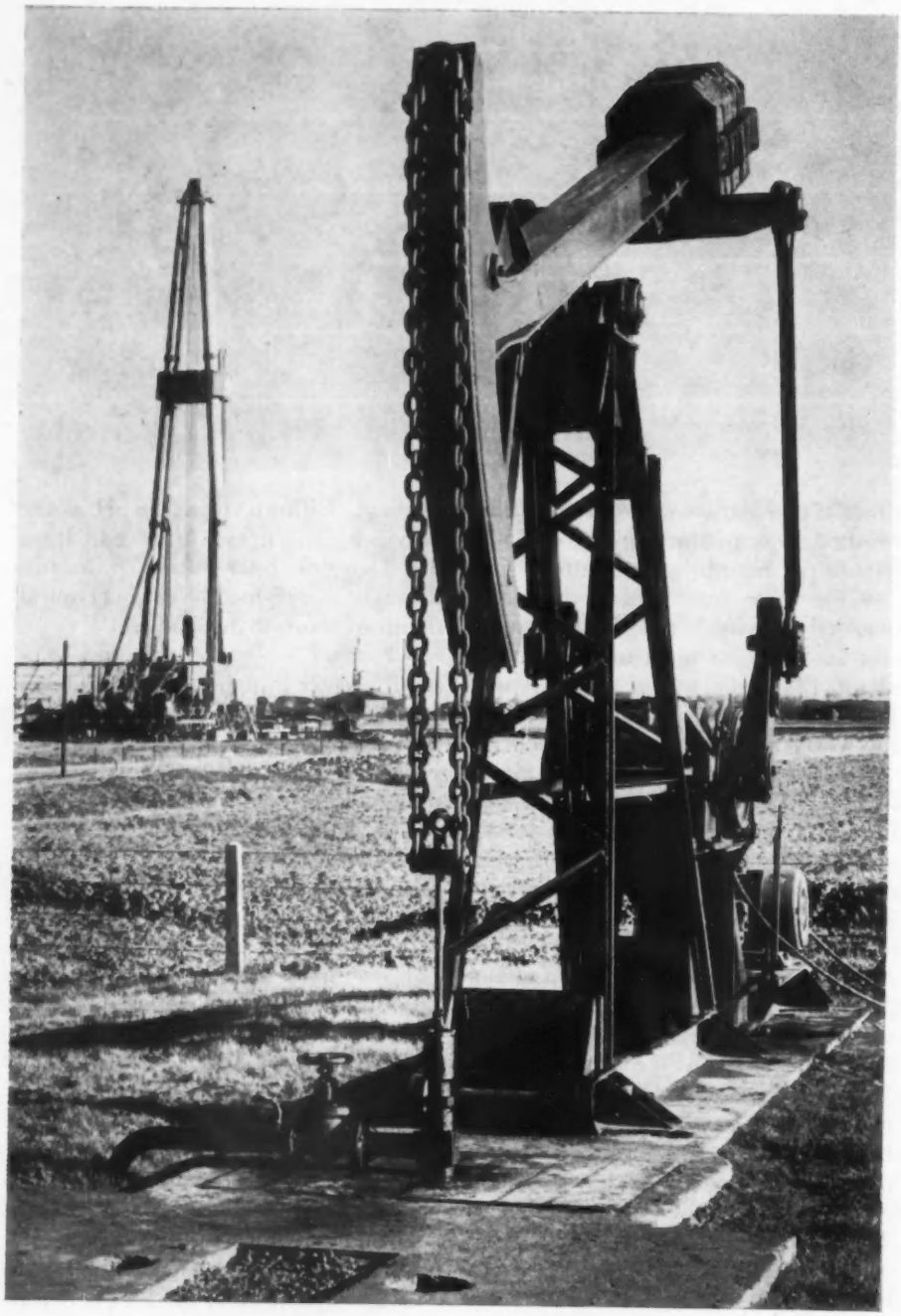


- The Eilte-West field in the Hanover oil province, a 1956 discovery, was further developed and produced about 12,000 barrels of oil in April, 1957. This pay also is a sandstone of the Dogger formation.
- A promising discovery was made in June, 1956, by Deutsche Erdoel-AG. in a fault zone between the salt domes of Gifhorn and Rolfsbuettel-Hillerse in the Hanover province. The wildcat Leiferde 1 came in with an initial flow of 350 barrels per day through a 1/6-inch choke from a depth of about 2720 feet. The oil was found in a sandstone of the Valendis (Lower Cretaceous).
- An apparently small find was made in August by the wildcat Rietze Dogger 1 of the Deutsche Erdoel-AG. near the old Eddesse-field at the western border of the Gifhorn trough The oil bearing formation is a sand of the Dogger at a depth of about 6000 feet.
- In January, 1957, Deutsche Edroel-AG.-Mobil Oil AG. was successful with the exploration well Hardesse 4, situated about seven miles west of Gifhorn town in Hanover province. The initial daily yield from the Dogger beta was 70 barrels through a 1/6-inch choke from a depth of more than 6000 feet.
- Further wells were drilled in a small Dogger trough west of the Lower Weser river by Gewerkschaft Elwerath, proving that the horizons in the Dogger sandstone were of smaller extension than could have been anticipated previously. In April, 1957, the Elsfleth field produced about 4000 barrels of crude.
- In Weser-Ems oil province, four discoveries were made in the second half of 1956 and in the spring of 1957 on the joint Oldenburg concession of Gewerkschaft Brigitta-Mobil Oil AG. The series of new discoveries was started in July by the wildcat Oythe 4, which found oil in the Upper Dogger formation (Cornbrash) and the Malm. It initially pumped 70 barrels of crude oil daily from a depth of 3800 feet. Up to now, the output from this deposit remained small.
- In September in the area between the older fields of Hemmelte-West and Quakenbrueck, oil was discovered at a depth of 1750-1800 feet by the wildcat Ortland 1. The pay occurred in

1956 German Crude Production and Drilling

REGION	Crude Production During 1956, By Region (Barrels)	Natural Gas Production During 1956, By Region (Cubic Feet)	No. of Crude Producing Wells at the End of 1956 by Region		No. of Natural Gas Producing Wells at the End of 1956 By Region	No. of Wells Drilling at End of 1956	Amount of Footage Drilled During 1956 (In Feet)	Field Wells Completed During 1956 and Results			Wildcat Wells Drilled During 1956 and Results		
			Flowing	Pumping				Oil	Gas	Dry	Oil	Gas	Dry
Bavaria	136,143	.....	4	8	....	9	183,249	1	1	1	9	5	10
Emsland	8,305,672	4,399,118,920	153	724	11	20	386,697	85	..	2	3	2	4
Hamburg*	391,380	.....	...	....	....	....	.....	...	..	..	..	..	..
Hanover	8,619,265	4,308,430	102	1,305	....	29	596,359	59	..	9	13	2	54
Schleswig-Holstein†	2,520,650	.....	104	151	....	11	269,796	15	..	2	2	..	17
Upper Rhine Valley	676,232	2,130,448,000	4	157	25	10	279,412	6	10	6	8	12	31
Weser-Ems	4,244,813	6,413,345,260	57	241	4	32	591,653	101	..	7	9	3	23
Others	.....	.....	...	....	....	1	15,613	..	..	..	..	..	6
Total	24,894,155	12,947,220,610	424	2,586	40	112	2,322,779	267	11	27	44	24	145

* See Schleswig-Holstein (apart from column 1).
† Including Hamburg (apart from column 1).



Immediately behind this pumping well in Germany's Heide oil field can be seen a Deutsche Erdoel A.G. portable drilling rig used in developing the field.

the upper-most Cornbrash. In April, 1957, Ortland was producing at a rate of about 5000 barrels of crude monthly.

• In the continuing development of the structural trend of Vestrup, the wildcat Harme 1 (Gewerkschaft Brigitta-Mobil Oil AG. found the oil sand of the Kimmeridge (Upper Jurassic). The initial yield from a depth of about 6050 feet was 120 barrels daily through a ⅛-inch choke. In early 1957, the exploration well Welpe 1, which is situated in the same area, also became a producer from a Kimmeridge sand at the depth of about 6275 feet. The hole initially flowed about 100 barrels daily through a ⅛-inch choke.

• In the Emsland district, a new natural gas field in the main Dolomite of the Zechstein formation was discovered in 1956 by wildcats Emlichheim Z1 and Z2 at a depth of about 8700 feet by the Wintershall AG.-Mobil Oil joint venture. The successful wells are situated south of the Emlichheim oil field, not far from the Dutch border. The production capacity of the well Emlichheim Z2 was between 0.7 and 1.8 million cubic feet daily.

• Four new gas discoveries were made during 1956 in the vicinity of Darmstadt town in the northernmost part of the Rhine valley graben.

• The center of the oil search in the Upper Rhine Valley currently is between Karlsruhe and Speyer on the left and the right bank of the river, where four new oil finds were recorded in 1956 and in 1957. It appeared doubtful whether one of these discoveries could be developed into a prosperous field.

• In September, 1956, the joint venture of Wintershall AG.-C. Dielmann struck oil with its wildcat Huttenheim 1, northwest of the old Forst-Weiher field. The pay was encountered at a depth of about 5270 feet in the Cyrenia marl. During the first production test, the well flowed at the rate of about 60 barrels daily through a 1/5-inch choke.

• A small discovery was made by Deutsche Erdoel-AG. seven miles south of the Landau field with its exploration well Minfeld 1. The initial yield was about 130 barrels daily through a ¼-inch choke.

• In March, 1957, Gewerkschaft Elwerath-DEA-Itag-Wintershall completed wildcat Hayna 1 between Landau and Minfeld. This well initially pumped about 30 barrels light oil daily from two sands of the Upper Pechelbronn beds at about 4500 feet.

• In April, 1957, on a concession north of Karlsruhe town owned jointly by C. Deilmann and Wintershall AG., the wildcat Leopoldshafen 1a found oil in the sandstone of the Meletta beds at a depth of about 4050 feet. During production tests, the well yielded 60 barrels of crude daily through a ⅛-inch choke.

• In Bavaria, gas was found by the exploration well Hohenlinden 1 of the Bayerische Mineral-Industrie (Mobil Oil)-PreuBag-Gewerkschaft Elwerath consortium. Hohenlinden is about 20 miles east of Munich. The gas was discovered in Priabon beds at about 7160 feet. Through a 1/5-inch choke, a flow of 62,000 cubic feet an hour was measured.

• In April, 1957, Mobil Oil AG. was successful with its wildcat Albaching 2, located six miles south of the oil and gas field of Isen. At a depth of about 8200 feet, the Lithothamnia

chalk proved to be gas-bearing. During production tests, the well yielded about 100,000 cubic feet per hour.

Supply and Demand. The annual oil consumption of West Germany rose by 21 million barrels in 1956 to 98 million barrels. The share of the domestic crude in refinery production of Western Germany remained at 30.6 percent—almost unchanged in 1956. About 58 million barrels of foreign crude were additionally imported during the year from Saudi Arabia, Iraq, Kuwait, Venezuela, Iran, U. S., and Mexico.

Exploration. Generally, 1957 exploration operations—as those of the previous year—were being directed toward borders of the Jurassic troughs in Schleswig-Holstein and Hanover, the Weser-Ems province, northern part of the Rhine Valley graben and in the Molasse basin, especially in eastern Bavaria.

Great Britain . . . Production stages comeback in 1956 after slight slump of 1955.

PRODUCTION IN ENGLAND recovered nicely from a slight slump in 1955, which was caused by depletion of the main oil fields near Nottingham. In 1956, production from Egmanton field, discovered in 1955, notably augmented production from older fields, and was instrumental in increasing output to 489,732 barrels for the year. This represented a daily average of 1338 barrels. The 1956 total was a full 95,032-barrel boost over the previous year's production, and represents a 24 percent rise compared to 1955.

BP Exploration Company, Ltd., in charge of exploration and production in England, drilled 70,320 feet of hole during 1956 in development wells. At the end of last year, all 221 oil wells were on pump. In addition, there were four shut-in gas wells. Nineteen wells were drilled during the year for field development purposes, with nine being completed as oil producers and ten as dry holes. An additional development well was drilling at the end of the year. Most of the development drilling was concentrated in Egmanton field, where 11 producers and 10 dry holes had been drilled in the field by the end of 1956.

Several stripper wells operated by Esso Petroleum Company, Ltd., at Dalkeith, Scotland, continued to produce at a combined rate of about two barrels daily during the year.

Exploration. Seismic and gravity surveys were conducted in several new onshore areas. Eight wildcats were completed without tangible results, and two were drilling at the end of the year. Six of these tests drilled in the East Midlands resulted in five dry holes and one non-commercial gas well located at Ironville in Derbyshire, drilled to 2742 feet. A total of 23,900 feet was drilled in wildcats completed last year in the United Kingdom.

Seismograph Service, Ltd., conducted the first offshore survey in British waters for The British Petroleum Company, Ltd., in 1956. The 1000-ton converted corvette Seislim was used in this operation, first in Robin Hood's Bay off the Yorkshire Coast in an area of Permian possibilities, and, later, along the Dorset Coast in the English channel off Swanage and Lulworth Cove in an area of Jurassic and Cretaceous prospects.

The operation had the additional function of serving as a shakedown cruise for new offshore equipment to be used by BP. Offshore surveys have been conducted by BP in such widely-separated parts of the world as the Persian Gulf off Abu Dhabi, in Gambia in West Africa, and Papua.

Partly due to the Suez crisis, British oil fields produced a total of 49,000 barrels in January, 1957, or about 1580 barrels per day during the month, the highest figure for any month since the end of World War II. BP reported three seismic parties, two on contract and the other a company crew doing reflection work in England during February, 1957.

Refining. Oil consumption in the United Kingdom increased by 8.5 percent last year over 1955, despite the Suez crisis. Demand in Britain currently exceeds 600,000 barrels daily. Refining capacities thus are strained to the utmost and vigorous expansion is being carried out.

At BP's Kent refinery, a 52 percent increase in capacity was under way. Two 10,000 barrels daily hydrofiners, a 2250 barrels daily alkylation plant, a 90,000 barrel-per-day distillation unit, a 10,000 barrels daily catalytic reformer, and a 12,000 daily thermal reformer all were under construction, with scheduled completion dates varying from late 1957 to mid-1958.

Shell Refining and Marketing Company, Ltd., had an 80,000 barrels daily distillation unit under construction at Shell Haven, scheduled for third quarter 1958 completion. Esso Petroleum Company, Ltd., had a 35,000 barrels daily capacity expansion program under way at Fawley, and a new hydrofining unit and other facilities under construction. The processing capacity of BP's Grangemouth Refinery in Scotland is to be raised from 44,000 barrels per day to 62,000 daily in a $12 million project announced May 20, 1957. A large distillation unit will replace a smaller one now in use. The Grangemouth expansion was to be completed late next year.

Greece . . . Drilling in two widely separated areas unsuccessful but encouraging.

IN GREECE, DRILLING has been conducted in two widely-separated areas within the past two years with unsuccessful but nevertheless encouraging results. And in early 1957, Greece's first refinery was scheduled for completion.

The Thrace Basin straddles the border between eastern Greece and European Turkey and contains marine strata ranging in age between Eocene through Miocene. One of three tests drilled on the Tavri anticline during 1938 and 1939 encountered oil shows which were not tested adequately.

Postwar exploration in Greek Thrace dates from 1953 when a group

was organized, composed 75 percent of Greek interests known as Ilios and 25 percent by Deilmann Bergbau GmbH of Bentheim, West Germany. Ilios-Deilmann conducted surface geologic and gravity surveys in 1953, and continued both means of exploration bolstered by reflection seismic work in 1954. In 1955, all three surveys were continued and a magnetic survey was added.

The first well, Ardanion 1, located about four miles north and slightly east of Ferrai near the Turkish border on the east flank of the Tavri anticline, was spudded June 15, 1955, and completed in 1956. Shows of oil and gas were reported at depths of 2444 and 6398 feet, but tests did not indicate commercial production.

A second test, Evros 1, was drilling at the end of the year, located two miles southeast of Ardanion 1 on a separate structure. It may be possible for Deilmann to move the rig back and forth across the Turkish-Greek border, since the German company has concessions in both countries and may be expected to drill in Turkish Thrace also as drilling accelerates there.

In far southwestern Greece, two U. S. firms, Israel Mediterranean Petroleum, Inc., and Pan-Israel Oil Company, Inc., had acquired a 120,000-acre concession on the small island of Zante early in 1957 and commenced drilling operations shortly after. The operators hoped either to restore the former sour crude production operated by Greek independents between World Wars I and II and by the Italians and Germans for military purposes during World War II, or to establish new production in deeper horizons.

A core drill rig, capable of about 2200 feet of depth, was shipped to Zante from Israel and by June, 1957, six tests, the deepest to 2100 feet, had been completed. Some shows of oil had been encountered, but results at the time were disappointing.

At Pireaus, a $15 million, 30,000 barrel-per-day refinery was being completed during the first quarter of 1957. It was built by Hydrocarbon Mineraloel GmbH for the Greek government. As it neared completion, a number of firms, including German, U. S. and Greek, were reported tendering competitive bids to operate the new refinery.

Italy . . . Future activity hinges on laws governing exploration and development.

See Page 336 for a review of Italian oil laws

Most of the interest directed toward Italy's petroleum industry in 1956 and 1957 hinged on the nation's laws governing exploration and development activity.

Approval of the latest oil law by the Italian Senate and Parliament resulted in the withdrawal of Gulf Italia (Gulf Oil Corporation) from the mainland. However, new applications for exploration permits have been made as several companies—both Italian and those from abroad—were relying on hopes that somehow intensified interest in offshore operations would lead the government to revise the current law governing mainland operations.

Oil exploration activities offshore in the Adriatic Sea apparently were to be made subject to a supplementary oil bill which reportedly will be more liberal than the present mainland code. Several informed oil circles expressed the belief that more liberal offshore regulations may force the government to revise the mainland rules.

Any immediate action on possible new oil regulations is difficult to forecast. It appeared unlikely that any decision would be taken by the government prior to the general political elections scheduled for May and June of next year.

Underlying Italy's oil and gas development during the past year was the fact that the nation's refining industry was not affected greatly by the Suez canal blockage. Domestic plants reported crude runs to stills during 1956 of 141.7 million barrels. Of that amount 76.4 million barrels were earmarked to help meet domestic requirements and 65.3 million barrels were for export trade.

Italy's domestic consumption of crude oil and petroleum products exceeded the output of domestic refineries allocated for domestic markets. The total for 1956 amounted to 77.8 million barrels as compared

Italy Drilling and Exploration Concessions Up to Sept. 30, 1956*

REGIONS	E.N.I. GROUP			PRIVATE COMPANIES			TOTAL		
	No. of Drilling Permits	No. of Exploration Permits	Area in Acres	No. of Drilling Permits	No. of Exploration Permits	Area in Acres	No. of Drilling Permits	No. of Exploration Permits	Area in Acres
Piemonte Valle d'Aosta	..	..	.....	..	2	6,622	..	2	6,622
Liguria	..	..	.....	..	..	.....	..	..	.....
Lombardia	..	..	.....	..	1	1,394	..	1	1,394
Trentino-Alto Adige	..	..	.....	..	..	.....	..	..	.....
Veneto	..	..	.....	11	105	153,044	11	105	153,044
Friuli-Venezia Giulia	..	2	167,601	..	..	.....	..	2	167,601
Emilia-Romagna	..	..	.....	27	98	390,055	27	98	390,055
Total North Italy	..	2	167,601	38	206	551,115	38	208	718,716
Toscana	..	..	.....	3	15	234,431	3	15	234,431
Marche	..	4	625,106	..	2	369,662	..	6	994,768
Umbria	..	..	.....	..	1	3,118	..	1	3,118
Lazio	1	..	3,590	1	7	582,234	2	7	585,825
Abruzzo e Molise	1	4	575,029	..	6	500,857	1	10	1,075,886
Total Central Italy	2	8	1,203,725	4	31	1,690,302	6	39	2,894,027
Campania	..	1	214,606	..	15	599,531	..	16	814,137
Puglia	..	..	.....	..	1	369,415	..	1	369,415
Basilicata	..	2	29,800	..	1	301,116	..	3	330,916
Calabria	..	..	.....	..	13	199,276	..	13	199,276
Total South Italy	..	3	244,406	..	30	1,469,338	..	33	1,713,744
Sicilia	..	11	892,431	1	32	2,626,211	1	43	3,518,642
Sardegna	..	..	.....	..	3	336	..	3	336
Total Islands	..	11	892,431	1	35	2,626,547	1	46	3,518,978
TOTAL	2	24	2,508,163	43	302	6,337,302	45	326	8,845,465

* Recently, E.N.I. has received exploration permits covering 2,471,000 acres and private companies have received exploration permits covering 4,769,030 acres.

with 66 million barrels for the previous year.

Production. Italy's crude production in 1956 amounted to 1,522,000 barrels, for a daily average of 4150 barrels. In 1955, total oil output of 1,581,448 barrels was tantamount to a daily average yield of 4332 barrels. At mid-year 1957, 21 flowing wells were in production.

Natural gas production last year was 157 billion cubic feet, up 12 billion cubic feet or 8.2 percent from 1955's gas yield of 145 billion cubic feet. During the first quarter of 1957, natural gas production showed an increase of 7 percent.

Po Valley. ENI has shut in a number of new gas producers in the Po Valley which were completed last year and during the first months of 1957.

During 1956, AGIP-Mineraria, ENI subsidiary, completed three gas wells in the Minerbio structure, about 12 miles from Bologna in the Po Valley. There, production had been calculated at 529,716 cubic feet per day.

In addition, AGIP Mineraria completed 70 development wells in the Po Valley last year with footage totaling 675,853 feet. In August, 1957, the company had 30 drilling rigs, of which three were deep drilling units capable of drilling to 16,500-20,000-feet.

Exploratory drilling in 1957 was being accelerated at Milano, Cremona, Novara, and Venice. According to the scheduled program, most of this drilling will aim at the 9800-foot depth. However, Well 23 at Cremona was scheduled to be drilled to a total depth of 16,400 feet.

Alanno Development. After Gulf's departure from the mainland, Montecatini Societa Generale per l'Industria Mineraria e Chimica took over the Gulf Italia share in the Petrosud Company and has continued developing the Gulf-discovered Alanno oil field. Swan 6, 7 and 8 wells have been completed.

Alanno field production has been hindered by the fact that one well has been producing considerable salt water.

Mediterranean . . . Malta activity stalled; Concession on Cyprus negotiated.

During 1956, drilling and exploration operations were carried out on islands in the Mediterranean Sea, including:

Malta. BP Exploration Company, Ltd., finished a three-well structure-stratigraphic drilling program. The first of the three shallow tests was completed early in the year at Zabbar, three miles inland from Valetta, the capital.

Since then, the exploration license has expired and has not been renewed due to the Maltese Government's insistence on terms unacceptable to BP. Reportedly, a deep test was being contemplated based on data previously gathered before negotiations for a renewal of the license broke down.

Cyprus. During 1956, Forest Oil Corporation of Bradford, Penn. negotiated a concession on the strife-torn island of Cyprus. The island has oil possibilities in the Cretaceous in low-lying areas, extending into shallow offshore portions.

Sicily . . . Competition spurs great strides in industry; Daily average output up 246 percent.

GREAT STRIDES were made during 1956 and 1957 in Sicily's oil industry due to the highly competitive situation which accelerated the search for and development of the island's oil and gas resources. Gulf Italia produced a total of 3.3 million barrels of oil from the Ragusa field, Sicily's only commercial oil pool discovered prior to last year. This output averaged 9016 barrels per day, representing an increase of 246 percent above the 1955 rate, when 2614 barrels were produced per average day to total 954,075 barrels for the year.

Crude production gained steadily during the year and had climbed to 18,000 barrels per day by early 1957. With the official dedication of Gulf Italia's 14-inch, 37-mile crude pipe line from Ragusa to Augusta, on the southeast coast of Sicily, on Feb. 4, 1957, the company relieved a highly congested transportation situation for Ragusa crude which formerly had to be transported by tank truck from the field. Gulf's 1957 production was expected to exceed the daily rate of 24,000 barrels.

Ragusa now appears to be a major field, having over 1000 feet of oil column in Triassic dolomites. Gravity of the crude is 19.8. Reserves are very likely comparable with those of Parentis field in France, or in the order of 125 million barrels.

It also appeared likely that a second major strike had been made in Sicily. At Gela, on the south coast of Sicily, 25 miles west of Ragusa field, AGIP-Mineraria, exploration agency of the Italian oil monopoly Ente Nazionali Idrocarburi, made an important oil discovery late in 1956. Gela 1 struck oil in Triassic dolomite in the intervals 10,236-10,498 feet and 10,597-11,056 feet. The oil is very heavy and viscous, being of 7 to 10 gravity, with a sulfur content of 8 percent. Pour point was reported at 65 degrees Fahrenheit.

Despite its unusual nature, oil was said to have flowed at Gela 1 at the rate of about 110 barrels per day, and, after pumping equipment was installed, it began to produce at the rate of 1200 to 1500 barrels per day in April, 1957.

Gela 1 was being offset with four stepout wells from 1500 to 2300 feet distant. Gela 2 was expected to be on production by August, 1957. Gela 3 was reported drilling below 8800 feet at midyear and Gela 4 was to be spudded upon completion of Well 3.

Anywhere outside of Sicily, the discovery of such heavy crude in commercial quantities at such a great depth would be considered a geological freak. Furthermore, Gela is in a down-dip position from Ragusa field, which is much shallower. In 1954, The British Petroleum Company found 5 gravity oil below 10,000 feet at Vittoria, but felt that the deposit could not be developed commercially.

After AGIP's success at Gela, BP announced that prolonged production

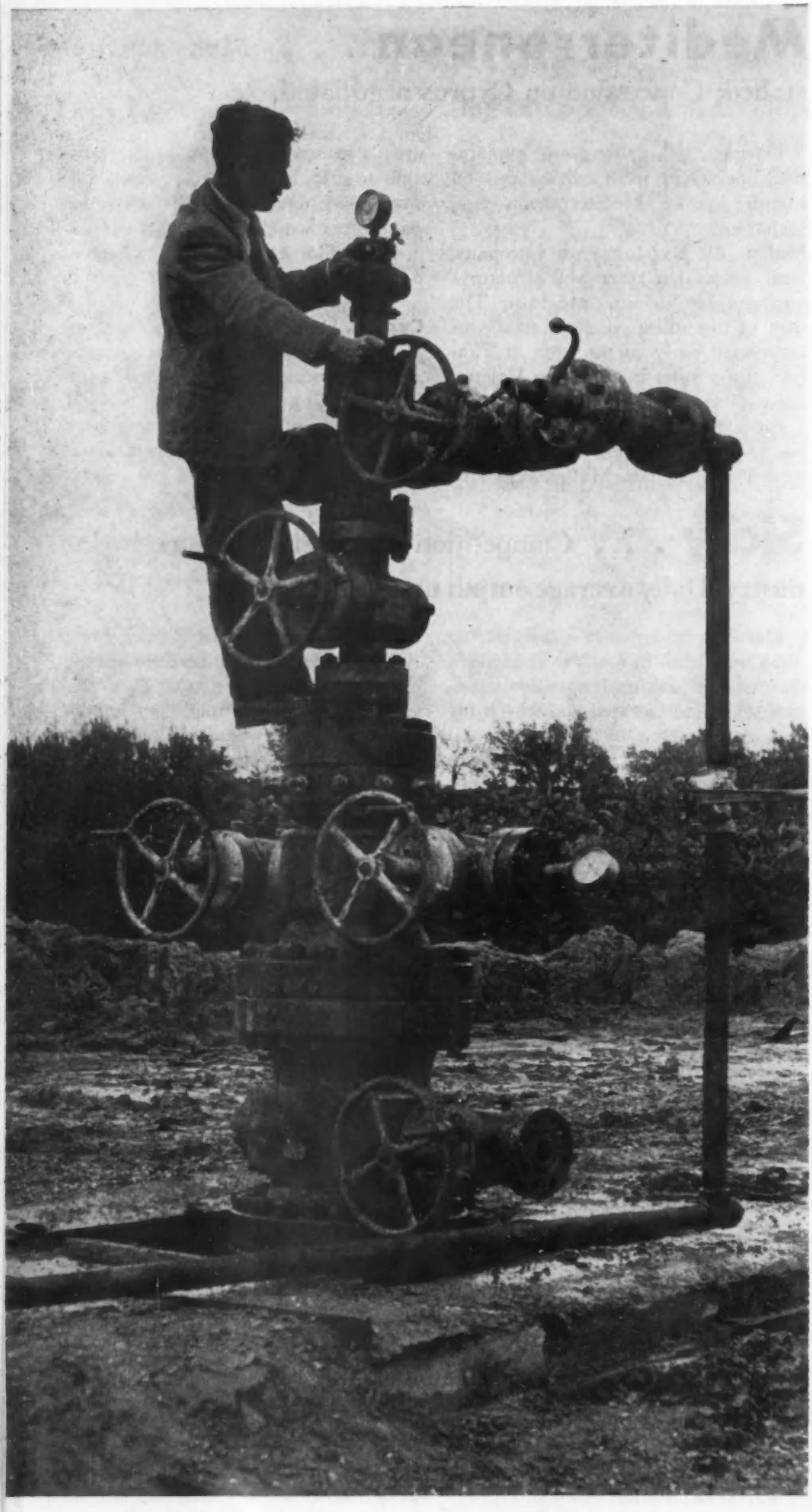


Photo courtesy Standard Oil Company (New Jersey)

This Augusta Ricerchi Petrolifere, S.P.A. engineer is checking a gage on the Christmas tree of a company gas well near Bronte, Sicily.

test was planned at Vittoria to determine whether the field could be worked to supply bitumen for road construction in Italy. At the same time, BP announced the location of its second deep test in Sicily at Troitta, near Caltagirone, to which a rig was being shipped from England.

At the end of 1956, Gulf had 14 wells producing at Ragusa, all on the pump. Three gas wells were producing at AGIP's Catania field in Eastern Sicily. Gas production amounted to 600,010,891 cubic feet, for a daily average of 1,639,374 cubic feet.

A total of 134,708 feet of hole was drilled in Sicily in 1956. Nine development wells, including four oil wells and two dry holes at Ragusa, were completed. Seventeen wildcat wells were completed in Sicily during 1956, including one oil well, six gas wells, and ten dry holes. Ten wells were being drilled as 1956 ended.

Augusta Richerche Petrolifere SpA (ARPE), jointly owned subsidiary of Standard Oil Company (Sicily) (a wholly-owned subsidiary of Standard Oil Company (New Jersey)), and Raffineria Siciliana Olii Minerali (RASIOM), completed small gas discoveries at Vasadonna and Bronte. The former is eight miles west of Catania on the south flank of Mount Etna, and the latter is on the west flank 25 miles northwest of Catania.

Bronte 1 was completed in an Eocene sand from 3885 feet to 3945 feet; Vasadonna 1 was completed in a Tertiary sand stringer from 2670-80 feet. Bronte 1 has produced gas at the rate of over 1 million cubic feet daily, but Vasadonna 1 appeared to be noncommercial.

Exploration. Gulf Italia and Gulf-Montecatini both were active in exploratory operations during 1956. Gulf Italia drilled dry holes at Licodia and Buccheri last year. Gulf-Montecatini was drilling one wildcat each at Avanella and Capizzi at the end of the year.

The Italian Edison Company utilized three seismic crews last year, and drilled two dry wildcats, one at Lentini, abandoned at 1743 feet and another at Poggioreale that reached 8475 feet. At year's end, three more tests, located at Trapani, Syracuse and Segesta were being drilled.

The concessions picture remained essentially unchanged, with 25 separate groups holding grants at the end of 1956. However, early in 1957, ENI

reached an agreement with the Sicilian regional government under which the former will create two or more Sicilian stock companies to conduct oil exploration. The government provides no initial risk capital, but may participate to the extent of 25 percent ownership if oil and/or gas is found. The government also collects the established royalty and taxes from production. ENI has been assigned almost 445,000 acres in Sicily.

AGIP made another discovery during 1956 a few miles southwest of Catania at Rizzo. Small quantities of gas in basal Quaternary sands were found, but the discovery appeared to be of minor importance. The well was drilled on a small anticlinal structure and completion was made at about 3050 feet.

Gulf Italia's 14-inch, 47-mile, $4 million Ragusa-Augusta crude pipe line was begun in April, 1956, and was virtually completed at the close of the year. Ragusa crude is now being moved through it to the 35,000 barrels daily RASIOM refinery at Augusta and to a sea terminal there. Storage facilities at the Augusta sea terminal have been enlarged to accommodate the increase in oil flow.

The new pipe line traversed rugged territory, with crews encountering hard rock at the surface virtually all the way. There were many steep ravines, as deep as 1400 feet to traverse. Some gorges were crossed via bridges. The right-of-way was only 19 feet wide, so that only light equipment could be used and much of the stringing was done by hand.

As of June 1, 1957, Ragusa's output had been raised to 21,000 barrels daily, and it was expected to reach 25,000 barrels per day by the end of June. Twenty wells were on production and three more were being drilled.

Refining. At the Augusta refinery, RASIOM was building a powerformer for October, 1957, completion, rated at 7500 barrels daily. Bonaldi-Crema was the construction contractor for the new $2 million unit.

Shell Italiana had been reported planning construction of a new 20,000 barrels daily refinery at Palermo. With the new Gela discovery appearing so promising, ENI also was reported to be negotiating with the Sicilian government to build a refinery at Palermo.

Spain . . . Vigorous exploration program promises early discovery of commercial oil and gas.

VIGOROUS EXPLORATION continued in Spain during 1956 and 1957. Numerous wells on known structures now have had good shows of oil and gas and have exhibited a good thickness of favorable sediments. Therefore, it appeared only a matter of time, assuming exploration continued at the rate of the past several years, until commercial deposits of oil and gas are found.

To accelerate the search, the Spanish government was reported early in 1957 to be considering liberalization of its laws to permit foreign capital to enter the oil search in Spain more freely. In recent years, non-Spanish firms have been allowed to participate in oil exploration only on a contract basis with Spanish or Spanish government companies, and with only a minority interest in the operation.

Compania de Investigacion y Explotacion Petroliferas, S. A. (CIEPSA), operating jointly with C. Deilmann Bergbau GmbH of Bentheim, West Germany, completed two important tests during 1956, and were drilling two more at the year's end.

Zuniga 1, located on the south flank of the large Gastiain anticline near the western border of Navarra Province in northern Spain, was abandoned finally by CIEPSA during 1956 at a total depth of 10,260 feet. This well previously was thought to be the first commercial producer in Spain after it had penetrated 12 gas zones in Albian (Cretaceous) sandstones below 3000 feet. The lower zones tested high pressure gas and salt water. Thorough tests of the upper sands indicated 95 percent methane gas but not in commercial quantities.

Alda 1, located three miles north of Zuniga 1 on the north flank of the Gastiain structure was drilling below 1850 feet at the end of the year. The test was projected to 16,000 feet for an exhaustive test of Cretaceous, Jurassic and Triassic sediments on the large structure.

About 38 miles west of Zuniga, in Alava Province, CIEPSA completed Apodeca 1 at 8310 feet with no shows reported.

In Burgos Province, Laños 1, located 12 miles south of Vitoria, was being spudded at the close of 1956. Another test, Treviño 1, was being readied at the same time.

CIEPSA and Deilmann continued a vigorous geological mapping and seismic program, with 21 party months of seismic work and 90 crew months of surface work having been conducted in 1956.

Valdebro. Valdebro, a group composed of the Instituto Nacional de Industria (INI) and American Interests primarily represented by DeGolyer and MacNaughton and General American Oil Company (a Dallas, Texas, independent), completed three deep tests in 1956 and was drilling another at the year's end.

Drilling operations spanned the country from extreme north to extreme south. In Santander Province in the far north near Bilbao, Matienzo 1 was drilled to a total depth of 6397 feet, penetrating Triassic and upper Permian evaporites, redbeds and sandstones. In northeastern Spain, Puigreig 1 was drilled to 10,470 feet in Barcleona Province, after penetrating a varied sedimentary section including thick beds of Eocene limestone.

Two tests were drilled in Cadiz, the southernmost province of Spain. Bornos 1 was drilled to 9940 feet near the northern border of Cadiz, encountering a very thick Triassic section with no shows. Almarchal 1, located between Gibraltar and the City of Cadiz near the Gibraltar Strait, drilled on a seismic prospect, found good gas shows between 2484 and 4879 feet, drilling depth at the end of the year. A larger rig was expected to be brought in to deepen the Almarchal test to basement, if possible.

Valdebro operated two seismic crews in Spain during the entire year, and had a gravity party in the country during most of 1956.

In northern Burgos Province, the Spanish oil marketing monopoly CAMPSA drilled Leva 2, seven miles west of Villarcayo. Oil shows were found in thin, tight sandstones in the upper Albian (Cretaceous) at 1672 and 1890 feet. The test penetrated about 300 feet of salt before being abandoned at 4940 feet.

Altogether, 50,317 feet of hole was

drilled in the six deep wells completed in Spain during 1956.

Shallow Tests. A number of shallow tests drilled in Spain last year included:

- Ralph Parsons and Company, Los Angeles, Calif., was reported to have drilled a shallow dry hole to 740 feet at Chinchilla 3 near Albacete in southeastern Spain.
- Sociedad Iberica drilled three shallow tests around the Orduña diapir south of Bilbao. These wells all were reported to be shallower than 2000 feet.
- Two wells in the Catalonian basin in northeastern Spain reportedly were drilled by a local firm without tangible results. Both wells were reported to be shallower than 3000 feet.
- In the Guadalquivir Valley of southwestern Spain, Empresa Adaro, subsidiary of INI, operating jointly with a subsidiary of the Italian oil monopoly, Ente Nazionale Idrocarburi, continued drilling shallow Tertiary tests to 3000 feet or less in an area where gas shows have been obtained previously.

Pipe Line. Work was virtually completed on the North Atlantic Treaty Organization product pipe lines, begun in 1955. The system runs diagonally across Spain from Rota on the southwest coast to Zaragoza in the northeast. The line is telescoped, including 12, 10, and 8-inch sections.

Refining. Expansion work on the Escombreras refinery, near Cartagena, was expected to be completed in 1957. The plant's ownership is dominated by Spanish capital, but the Caltex group has a 24 percent interest. Capacity before the recent expansion was 45,000 barrels per calendar day. Foster Wheeler Corporation was engineering and construction contractor for a 25,000 barrel-per-day topping unit, an 11,000 barrels daily platformer, a $10 million LPG unit, and outside facilities at Escombreras. Charging capacity is expected to rise to 60,000 barrels per day.

At Spain's other refinery, at Tenerife in the Canary Islands, a new 35,000 barrel-per-day crude oil distillation unit was installed. Capacity of the Tenerife refinery, with the new unit added, is about 65,000 barrels per day. A Spanish group, Compania Espanola de Petroleos, operates the Tenerife refinery.

The Netherlands . . . Crude production up; two new fields in western Holland.

HOLLAND'S BOOMING oil industry continued to advance with important strides being made in producing, exploration and refining during 1956 and 1957. Total crude production was 7,651,519 barrels last year, an average of 20,906 barrels per day, representing a 7.21 percent increase over the 1955 total of 7,136,808 barrels or 19,553 barrels per day.

Production in Western Holland, non-existent prior to 1953, now fulfills about one-seventh of the nation's crude output. Its importance was emphasized by the fact that during 1956, crude yield from Schoonebeek field declined slightly, but total production increased significantly because of the rising production in Western Holland.

New Fields. Two new fields were found in the western area of The Netherlands in 1956, and both were on production at the end of the year. The discovery at Wassenaar yielded a flow of 600 barrels of 19-gravity crude from lower Cretaceous sandstone at 4100 feet and established a record for production from an individual Dutch oil well. A second well resulted in a dry hole at Wassenaar and a third was being drilled at the end of 1956.

Production of 173,215 barrels catapulted Wassenaar into fourth place among producing oil fields in The Netherlands in 1956, though completion of the discovery was made in September.

The other 1956 oil field discovery was made at Ijsselmonde, on the south bank of the Maas River in Western Holland, about six miles from Rotterdam, not far from the Pernis Refinery. At the end of 1956, the discovery well was flowing 63 barrels of 18.4-gravity oil from Upper Barremian sandstone (lower Cretaceous) at 3100 feet. A second well there was being tested as the year ended.

Other wildcat well locations drilled during 1956 were at De Lutte, Ten Boer, Rammelbeek, Almelo and Leid-

Portugal . . . Exploration pushed; two wells abandoned, third being tested at 7500 feet.

ACTIVE OIL exploration is being carried on in Portugal by Mobil Exploration Portugal, Inc., under contract with Compania dos Petroles de Portugal. The former, of course, is a Socony Mobil affiliate. The latter has as major stockholders the Portuguese government and the Swedish Axel Johnson firm, according to the American Association of Petroleum Geologists Bulletin.

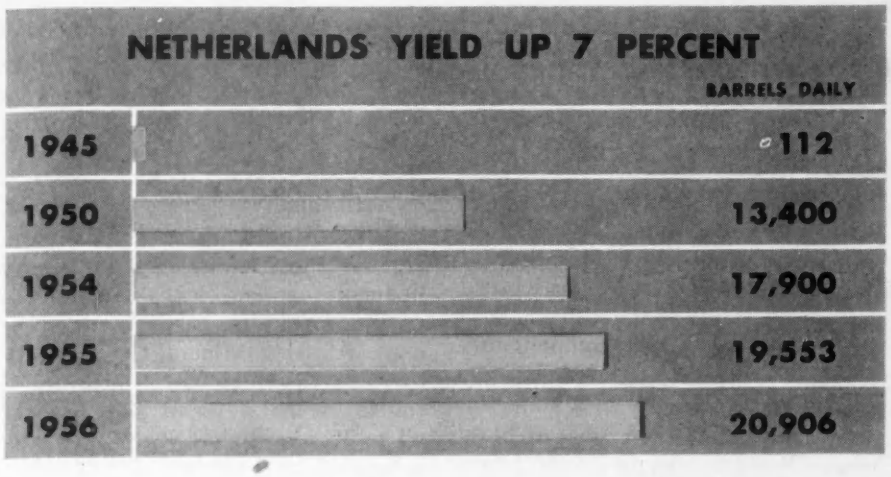
Surface geology, gravity and reflection seismic surveys were being followed up by drilling, with one rig operating continuously. In 1955, Pinhal Novo 1, the first test, located about 12 miles east and slightly south of Lisbon, was drilled to 5497 feet in Triassic and abandoned.

The next test, Arruda 1, located about 20 miles north of Lisbon, was drilling at the start of 1956 and was later abandoned at 7010 feet in upper Lusitanian conglomerates (Jurassic).

A third test, Barreiro 1, located four miles southeast of Lisbon, had reached a depth of 11,884 feet by the end of 1956, and upper Lusitanian limestone was being tested at 7500 feet.

In 1956, Portugal imported an average of 20,200 barrels of crude per day and 18,400 barrels of petroleum products. About 4000 barrels of products daily were exported.

There is one refinery, at Capo Ruivo, Lisbon, operated by S. A. Concessionaria Da Refinicao de Petroleos En Portugal (Sacor). Rated capacity is about 30,000 barrels per day. Facilities include a cat cracker, polymerization unit and a lube oil plant. A tank farm at Socavem upstream from the refinery along with a connecting pipe line was scheduled for completion in October, 1956. In September, 1956, the first shipment of Angola crude arrived at the Sacor refinery for a test run. Increased shipments of Angola crude may be expected as production there rises.



schendam. At De Lutte, Well 5 found gas in the main Zechstein (Permian) dolomite about 3½ miles east-southeast of the 1955 gas discovery at Rossum, on a trend of gas fields lying west of Schoonebeek field. At Ten Boer 1, a minor gas discovery was reported in the same horizon, about 4 1/3 miles northeast of Groningen. A similar find was reported at Rammelbeek, 5 1/3 miles northeast of Rossum. A more recent gas discovery was reported near Noordwijk on the west coast.

All together, 12 development wells, including seven oil wells and five dry holes, were completed during 1956. Of seven wildcats completed, two found oil, three produced gas, and two were dry holes.

A deep test, Schoonebeek 313, being drilled late in 1956 to test a possible gas zone at 10,000 feet, was later suspended. Another wildcat 4 1/3 miles southwest of The Hague was suspended also. N V Nederlandse Aardolie Maatschappij (NAM), operating in The Netherlands, composed of Royal Dutch Shell and Jersey Standard interests on a 50-50 basis, continued geophysical work during 1956 with two seismic crews, one company and the other on contract, operating on the mainland.

In addition, five months of gravity work were carried out by a crew surveying a possible extension of the Western Holland productive trend into the adjoining North Sea area.

NAM applied for an extension of 469,119 acres to the Rijswijk concession on April 20, 1956.

NAM's deliveries of natural gas to the government's system for transmission and distribution to consumers was reported to have been increased substantially in 1956 when it reached the rate of 14,125,600 cubic feet daily. NAM has committed itself to deliver at least this much to the government's facilities over the current 20-year period.

A major crude reserve exists at Schoonebeek in Valanginian (Lower Cretaceous) sandstones. The pay varies in thickness from 16 to 130 feet, porosites reach 33 percent and permeabilities average five darcys. The field covers about 9½ square miles. Salt water is being produced with the oil on a ratio by volume of about three to one, respectively. The salt water is reinjected to maintain reservoir pressures.

The 25.1 gravity, paraffin-base crude at Schoonebeek solidifies at 55° F. Eighteen blockstations are distributed through the field largely for this reason, to separate oil, gas and free water and to heat and pump the remaining emulsion to a central tank tank station where the emulsion is broken by chemical and electrical means. All methods of secondary recovery, including water and gas injection, hot water injection and *in situ* combustion, were being attempted to determine the most effective ways of producing the maximum ultimate yield. Cumulative crude oil production from Schoonebeek field at the end of 1956 was 50,074,061 barrels.

Early in 1957, due partly to the oil shortage owing to the blocking of the Suez Canal, greater emphasis was placed on development drilling in Western Holland and less on wildcatting.

Refining. Crude throughput at the Pernis refinery, Western Europe's largest, increased during 1956 by almost 15 percent to more than 230,000 barrels daily. A second cat cracker went on stream, and construction of a 2800 barrels daily alkylation plant was begun, scheduled for first quarter 1958 completion.

In addition, two hydrodesulfurization units, with daily capacities of 16,400 and 7800 barrels daily, respectively, were under construction and scheduled for completion during the second quarter of 1958.

At the Pernis refinery of Caltex Petroleum Mij (Nederland) N V, a new 7000 barrels daily platformer went on stream early in 1957. The refinery has a daily crude throughput capacity of 46,000 barrels.

On June 19, 1956, Jersey Standard announced that Esso Nederland N V would build a refinery near Rotterdam, to charge 30,000 to 40,000 barrels of crude per day. Construction of the new $29 million project on a 395-acre site was to start in 1957 and be completed in 1960.

Development Drilling and Crude Oil Production in The Netherlands, 1956

NAME OF FIELD	Footage Drilled in 1956	WELLS DRILLED IN 1956				Wells Drilling at Dec. 31, 1956	WELLS PRODUCING AT DEC. 31, 1956			Producing Depths	1956 Production (Barrels)	1956 Daily Production (Barrels)	1955 Production (Barrels)	1955 Daily Production (Barrels)
		Oil	Gas	Dry	Total		Flowing	Pumping	Total					
Schoonebeek	18,044	2	0	0	2	0	0	258	258	2,500	6,680,149	18,252	6,712,482	18,390
Rijswijk	15,715	2	0	1	3	0	8	2	10	5,100	388,595	1,062	289,643	794
Pijnacker	22,090	2	0	2	4	0	3	0	3	5,800	271,633	742	82,558	226
Wassenaar	13,565	1**	0	1	2	1	1	0	1	4,100	173,215	473	0	0
De Lier	16,015	1	0	1	2	0	2	0	2	5,300	75,106	205	10,679	29
Berkel	0	0	0	0	0	0	0	3	3	3,600	30,584	84	20,465	56
Delft	0	0	0	0	0	0	1	1	2	3,800	21,180	58	17,179	47
Ijsselmonde	9,029	1**	0	0	1	1	1	0	1	3,100	11,057	30	0	0
Andel	0	0	0	0	0	0	0	0	0	3,900 and 4,700	0	0	3,802	10
Total	94,458	9	0	5	14	2	16*	264	280*	.....	7,651,519	20,906	7,136,808	19,553

* Does not include producing wells in gas fields in The Netherlands.
** Discovery wells included to show total crude production.

Austria . . . Shift in government policy may increase interest from abroad.

AUSTRIA'S GOVERNMENT has shown that it is willing and actively interested in settling the claims of Western oil companies which suffered at the hands of the Germans and, later, the Russians. The Western-oriented government has realized that only the compromise settlement of these claims will restore a favorable investment climate.

The drive toward more nationalization has been stopped completely, both by the Peoples' Party and its private enterprise platform and the Socialist Party, which has agreed not to expand its nationalization efforts despite its desire. This assurance, plus the settlement of Vienna Memorandum provisions, is pointed to as the basis for increased interest from abroad in the Austrian oil industry.

Object of such interest is the more than 80 percent of Austria which has not yet been awarded under concession to any group. However, part of this area is blocked to oil companies from abroad by provisions of the Austrian State Treaty.

Austria's position in the heart of Europe may have a healthy effect economically on Central and West European business. If the proposed pipe line from Trieste to Vienna is built and if Austria doubles its refining capacity within four years from the 1956 level, increased oil trade from abroad is likely.

However, Austria's biggest problem is the relation between its crude production and both domestic requirements and commandeered exports—indicating a prolonged future of forced imports.

The year 1956 was the first since 1937 that Austria controlled its own oil industry. However, it was also the year in which the nation's position as a leader among West European crude producers was lost to West Germany and the year Austria learned that its oil status would worsen, particularly in view of the compensatory deliveries to Russia.

Austria's sovereignty as a state still is impaired by the 1955 Austrian State Treaty. For example, no foreign group may acquire from the state any concessions or other rights in fields which from 1945 to 1955 were operated by Russia.

On the other hand, Austria needs foreign capital, especially for refining. And settlements of parts of the Vienna Memorandum, i.e., the partial return of producing and refining companies, are believed instrumental in possibly attracting foreign capital.

Austrian oil is a heated political issue. Not only did the Austrian nationalized oil industry last year pay for Soviet deliveries of 8,145,600 barrels of oil (about 35 percent of total output), but also furnished $11,538,000 for the government's milk price stabilization program.

The Hungarian rebellion, in which Austria's oil industry participated generously, left a deep imprint on the industry in two ways:

- Soviet-directed shipments of Austrian compensatory crude deliveries were halted for weeks, completely filling available storage facilities.
- Insufficient delivery of Rumanian and Hungarian products caused a drastic reduction in refinery runs in 1957 when the deliveries had to be made in a hurry.

A visit of Soviet First Deputy Mikojan, chairman of the Council of Ministers of the USSR, to Vienna, it was hoped, would be the occasion for a voluntary reduction of Soviet delivery demands. Such a move had not taken place, but Austrian Chancellor (Premier) Julius Raab was invited to Moscow during the fall of this year. Austria hoped to see its deliveries reduced then.

Austria's oil administration was reorganized in 1956 as a special agency under the management group for nationalized enterprises, retaining the name Austrian Mineral Oil Administration. AMOA's biggest liability, of course, is the series of shipments of oil to Russia. Value of the deliveries is between $19,230,000 and $23,076,000 a year.

Drilling. Austria's 1957 drilling program called for completion of 125 development wells, with total footage of 630,118 feet, and 22 exploratory tests. The program also calls for maximum drilling at Matzen field. The field's southern half was scheduled to be the site of 85 development wells at depths ranging from 4429 feet to 4495 feet, in an effort to produce oil from the 8th and 10th Tortone horizons (See Table 1).

Nine wells were scheduled to be drilled in the northern section of the field. Two were to be drilled to 5446 feet and seven to the 6233-6397-foot level.

Well Puchkirchen 1, the first producing well outside existing East Austrian fields, produced 1798 barrels of oil during the first 26 days of May, 1957.

AMOA's 1956 drilling activities included wells at Spannberg, Rabensburg 9 and 10, Palterndorf, Glinzendorf, Kledering, Kagran, and Pyrawarth.

Production. Crude production for 1956 amounted to 23,267,570 barrels, or a daily average output of 63,572 barrels. This was tantamount to a decrease of 1,584,058 barrels from the previous year, or a drop in daily average yield of 4515 barrels. The 1955

Austrian Crude Oil Production

COMPANY	FIELD	Crude Production in 1956	Crude Production in 1955
Austrian Mineral Oil Administration	Muehlberg	1,979,124	2,242,307
Austrian Mineral Oil Administration	Neusiedel/Zaya	737,390	700,318
Austrian Mineral Oil Administration	Matzen, Auersthal and Bockfliess*	18,684,726	19,502,895
AMOA and Erdoel Produktions Gesellschaft	Goesting	266,648	291,382
Rohoelgewinnungs-gesellschaft	Gaiselberg	726,457	713,928
Van Sickle Company	Neusiedel/Zaya	214,787	235,720
AMOA	Aderklaa	639,988	.....
Rohoelgewinnungs-gesellschaft	Puchkirchen	18,450	.....
	Others	.....	1,165,078
	Total	23,267,570	24,851,628

1957 Austrian Drilling Program

FIELD	No. of Wells	Projected Depth (In Feet)
Matzen:		
South	85	4429–4495
North	9	5446–6397
Raggendorf	7	6561
Bockfliess	4	4429
Aderklaa	3	7874
Muehlberg	2	1–5740; 1–7053
Zwerndorf	4	4921
Others	33	n.a.
Total	147	....

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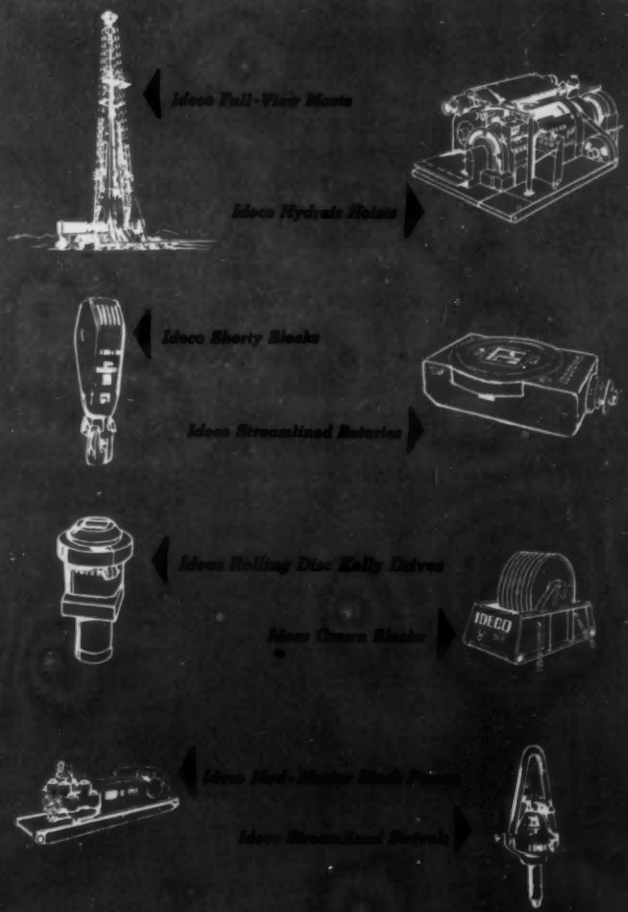

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average daily crude output of 68,087 barrels was an all-time high.

Cumulative production from Austria's oil fields amounted to 198,897,662 barrels through 1956.

Natural gas production also declined last year, as total output slipped to 26.3 billion cubic feet from 27 billion cubic feet produced during 1955.

Pipe Lines. Last year AMOA Director General Koeck suggested consideration of the construction of a pipe line from Trieste harbor to Vienna, not only for Austria alone but also for neighboring countries of Switzerland, West Germany, Czechoslovakia, and Hungary. The pipe line would be 400 miles long.

Currently under construction are:

1. A 13.6 mile oil pipe line connecting Bockfliess oil field with Korneuburg refinery, with an annual capacity of 8 million barrels.

2. Natural gas trunk line from Zwerndorf gas field to Schwechat refinery. This 21-mile line was expected to be commissioned late this year.

Refining. Austria's total refined products last year amounted to approximately 10.2 million barrels, an increase of about 1.7 million barrels from the 1955 level of 8.5 million barrels.

Exploration. Exploration activities, accelerated during 1956, were continuing in 1957 in Eastern Austria by AMOA, in the Upper Austria/Salzburg area by Rohoelgewinnungs A.G. (RAG), and in Vorarlberg province by a 1956-established provincial-sponsored company.

In the east, AMOA was proceeding with operations in the Rabensburg areas along the Czech border, where three wells were being drilled, at the Spannberg deposits, and in the Kagran area.

The Rabensburg area has been drilled frequently, but no well had reached the natural gas horizon. The Spannberg wells are partially exploration tests in that the continuation of the Helvet formation of Matzen field is to be checked.

AMOA planned that 22,965 feet of hole would be drilled this year in structural holes. Ten wells, each 2297 feet deep, were to attempt to prove up the geological structure at Wittau.

RAG, a Mobiloil-Shell joint venture, found oil last year at the Puchkirchen drilling site in Upper Austria. Since the beginning of operations in the Upper Austria/Salzburg exploration program, RAG operations also include dry holes at Bath Hall 1, Puchkirchen 2 and Geretsberg 1. Other RAG activities include geological and geophysical operations in the general area of the western section of Upper Austria.

At Vorarlberg, gravimetric studies have been concluded by Vorarlberg Erdoel Forschungsgesellschaft, and seismic studies were to follow up during the fall of 1957. The company is owned 60 percent by the provincial government and 40 percent by private businessmen.

AMOA has five fully-equipped geophysical teams in the field, of which one was taken over from the Soviet Mineral Oil Administration and two are operated by foreign firms which had—or were to receive—exploration orders from AMOA. The two remaining AMOA parties were expected to be fully outfitted with U. S. equipment this year.

Also last year RAG proved through reflex-seismic studies in Upper Austria the existence of a promising structure in the Neukirchen-Aspach area.

New Fields. The following new fields went into production last year:

1. Spannberg, an oil field about three miles from Matzen field.

2. In the Vienna municipal territory, production of natural gas began after Kagran 8 well proved successful.

3. RAG began producing its single well in the Puchkirchen field in Upper Austria province.

Concessions. More than 50 applications for exploration and production concessions had reached the Austrian Supreme Mining Authority, a branch of the Federal Ministry of Trade and Reconstruction.

The only two concessions issued so far deal with RAG's license in Upper Austria province and the Niogas license, which was issued for political reasons—to bring about a compromise between the Niogas-attached conservative People's Party and the Socialist-dominated AMOA.

General Economics. Commercial, rather than ruthless, development of the nation's oil fields has led to a steady decrease in Austria's crude production. The 1958 output is expected to reach 19 million barrels, slipping in 1960 to about 16.6 million barrels—provided no new oil fields are discovered. The 1963 production figure, then, would slip beneath the 13.5 million-barrel level.

In 1958, the nation's total output of crude, minus Soviet reparation deliveries, will leave Austria with 10.9 million barrels for domestic use; in 1960, Russia will siphon off its 8.1 million barrels from Austria's production of 16.9 million barrels to leave only 8.8 million barrels for domestic requirements.

Austria's 1956 consumption from domestic crude resources amounted to 10.4 million barrels, plus 1.8 million barrels of imports. Thus, last year's total consumption amounted to about 12.2 million barrels.

After rising from 6.9 million barrels in 1953 to 11 million barrels in 1955, Austria's annual domestic requirements trend is expected to reach the 12.9-13.5 million barrel range in 1958. At that time, domestic supply is expected to furnish only 10.9 million barrels after fulfilling obligations to Russia.

Imports, then, would have to increase more than 2 million barrels in 1958. This would mean that in five years, Austria will be forced to cover about half of its domestic requirements from imports, while sending to Russia an amount equal to import requirements.

In this calculation, no exports have been included. That means that Austrian exports would be halted completely, beginning from 1958.

Solutions? To ease the growing difficulties with which the oil industry is faced, three possibilities were being viewed:

1. The possibility of Russia, upon request, reducing its reparation demands.

2. The importation of sufficient crude to utilize an increased refining capacity.

3. Stepping-up of exploration work in the search for new supplies of oil.

Current Trend. Oil operations in the first quarter of 1957 revealed no trend that caused optimism. Crude production decreased by 5.9 percent during the first quarter, refining throughput dropped by 3.5 percent, and 30.8 percent of the production obtained during that period was shipped to Russia.

Iran . . . Further expansion due as recovery from nationalization is almost complete.

THANKS TO strenuous efforts by the Iranian Consortium and its member companies, the Iranian industry has essentially recovered from the disastrous effects of the 1951 nationalization. This is the final year in which actual production quotas are to be imposed on the Consortium, and they are being exceeded. Greater expansion efforts to enhance even more extensively the importance of Iranian oil on the world's markets are moving ahead.

Rehabilitation of the Abadan refinery is virtually finished. Iran Oil Company, subsidiary of the government-owned National Iranian Oil Company, found on extensive new source of oil in August, 1956, at Qum, 75 miles south of Teheran, spectacularly illustrating the oil potential of unexplored stretches of the remote Iranian hinterlands. Exploration was proceeding in several widely-separated regions, both inside and outside of the Consortium area of South Iran.

Apparently there was no widespread damage to the oil reservoirs shut in during the nationalization period; production was increasing, and an important field extension, increasing the reserves of the Agha Jari field, was made. And to facilitate development, the government was considering liberalization of its laws in mid-1957 to permit more foreign capital to enter the country to finance exploration in new areas.

Total 1956 crude production in Iran was put at 198,289,131 barrels, for a daily average yield of 541,774 barrels. This sum includes 195,581,331 barrels (534,375 barrels daily) produced by the Consortium, and an estimated 2,707,800 produced and refined by National Iranian Oil Company through its subsidiary, Iran Oil Company. The 1956 figure represents a 62.35 percent increase in the daily rate over the previous year.

National Iranian Oil Company produces about 3300 barrels daily from several wells near the Iraq border at Naft-I-Shah field. The oil is topped there, and treated crude is moved through a high-pressure 3-inch line about 100 miles eastward to the Kermanshah refinery, from which products are marketed locally. Diesel fuel from the Naft-I-Shah topping plant is transported through a 4-inch pipe line (built during the Nationalization period 1951-54) northward 43 miles to a 2000 barrel per day fuel oil terminal at Kalantar, near Kasr-I-Shirian, for local use.

Normally none of the estimated five million barrels of oil that escaped after the August 15 blowout last year at Qum would be counted as production, since the yield was not intentional. However, in this case the oil was diked off into artificial lakes, solidified, and some was marketed and used in Teheran for industrial purposes. Production at Qum is similar to that from South Iran in that both come from the Asmara limestone.

The Qum discovery is located far from any other producing area. Lali field, northwesternmost of South Iran's fields on a trend parallel to the Zagros Mountains lies 200 miles southwest, Naft-I-Shah field is 320 miles west, and Russia's Baku fields on the Caspian Sea are more than 300 miles to the northwest.

The Qum discovery is the result of about six years' work, which commenced in 1950 with the engagement of seven Swiss geologists headed by Dr. Arnold Heim of Zurich. After a general survey of prospective areas ranging from the Caspian Sea to the Indian Ocean, the Qum area was selected as the first to be drilled. Two prominent anticlines were located and mapped, and the first test on the Alborz structure, about 40 miles long from east to west and about six miles wide at the outcrop, was staked. Miocene redbeds were at the surface, underlain by salt which, in turn, apparently is underlain by the Asmari limestone.

On the Alborz structure, dips of 45 degrees occur at the south fringe, lessening northward to the relatively flat, broad crest, rapidly increasing to vertical and even slightly overturned at the extreme north flank.

Alborz 1 recovered cores indicating high-angle dips and slight oil shows below 4000 feet and was abandoned at 4592 feet due to technical difficutlies. Marker horizons found in this range indicated a thrust, necessitating drilling part of the same section twice in the same hole.

A core drill rig then was brought in to drill Alborz 2 for geological data which, after reaching 2197 feet, removed any doubts that local thrusting had occurred.

Alborz 3, the second deep test, was located four miles west of Well 1, where it was expected that local thrusting effects would die out. Drilling began during the winter of 1952. By June, 1952, the test had reached 7504 feet, where 300 barrels of highly-viscous, low sulphur content oil flowed in 48 hours, together with considerable gas under high pressure. Delays were caused by lost circulation, caving, fishing, and financial troubles, and Alborz 3 finally was abandoned at 7554 feet early in 1953.

Alborz 4 then was located about three miles southeast of Well 3, drilled to about 8000 feet in the evaporite section above the Asmari limestone. It was abandoned due to technical difficulties without reaching the objective zone.

Finally, Alborz 5, located close to Well 3, was drilled, successfully penetrating 1367 feet of salt immediately above the zone from which the violent oil eruption occurred. The contractor, Drilling and Exploration Company, Los Angeles, Calif., had reached 8782 feet on Aug. 26, 1956, when the drilling fluid was suddenly blown out of the hole. There was barely enough time to cut the engines and move away from the rig when oil gushed to a height of over 300 feet, producing an estimated 80,000 barrels per day of 33 gravity, paraffin base oil and great quantities of gas.

Approaches to the well were guarded by 600 men of the Iranian military forces so as to reduce the fire hazard. Crude oil flowed out into the open desert through a channel four miles long into a large natural depression. Earthen dams were hastily constructed to enclose the oil and to separate it from surface water. (See WORLD OIL, December, 1956, Page 206.)

On April 22, 1957, Alborz 6 was spudded at a location 1½ miles west of Well 5. A second rig was to be brought into the area in July. Iran Oil Company hoped to complete six wells at Qum by the end of 1958.

Size of the Qum crude reserve is conjectural since only one well had been completed. The oil shows in

Alborz 1, four miles east of the discovery, however, were encouraging. Since the area is highly disturbed, there is danger of cross-faulting, so that the structure may not be oil-bearing in its entire length.

It seemed reasonable to expect, however, that production from Qum would be able to satisfy Iran's domestic needs, now running at about 40,000 barrels per day. If confirmation tests at Qum are successful, a refinery might be constructed, products from which might be pumped into the Ahwaz-Teheran pipe line system which passes within a few miles of the Alborz structure.

If a surplus for export is developed, it might be pumped to Abadan on the coast via the same system. There is some long-range consideration of a large-diameter crude oil pipe line, 1000 miles long, from Qum through northwestern Iran and eastern Turkey to Iskenderun on the Mediterranean coast. However the rugged territory, high costs, financial burden, and scarcity of pipe are obstacles to the planning.

Following the Qum discovery, Iran Oil Company began a core drill program in February, 1957, along the south shore of the Caspian Sea near Aliabad. This activity followed up a gravity survey of the Caspian south shore in 1951 and a seismic survey in 1955. Drilling and Exploration Company, the same firm handling drilling at Qum, is the contractor for the core drilling.

It was hoped that the productive trend in the Baku area across the international border in Russia will swing around to the south shore of the Caspian.

Ente Nazionale Idrocarburi (NEI), the Italian government oil monopoly, made overtures to National Iranian Oil Company early in 1957 toward setting up a joint NIOC-ENI company to prospect for oil in several regions in Iran. As of mid-1957, NIOC, in order to make its agreement with ENI effective, would have to acquire the approval of the Iranian Parliament, as was necessary before the 1954 agreement with the companies comprising the Consortium could be activated. The Iranian government retained the services of Elmer Batzell, oil lawyer of Washington, D. C., during mid-1957, in an apparent attempt to prepare and introduce legislation that would allow entities other than those of the Iranian government to explore for and develop oil production in Iran outside of the Consortium area.

Should such legislation succeed and should it make the NIOC-ENI effective, the two governments then would form a company called Societe Irano-Italienne des Petroles with NIOC controlling 51 percent of the capital and ENI, 49 percent. Three areas, totaling 9000 square miles, would be explored, located as follows:

- First zone, north of the Abadan district in the Bagros mountains.
- Second zone, in Mekran Province along the Pakistan frontier and the Gulf of Oman.
- Third zone, offshore in the upper Persian Gulf from Bandar Shapour to Bandar Abbas in 70 to 100 feet of water.

The last joint of pipe was laid on the Ahwaz-Teheran products pipe line on Feb. 2, 1957, and the 10-inch line, expected to have a capacity of 30,000 barrels of gasoline daily, was pumping 10,000 barrels of gasoline per day from the Abadan refinery to Azna, 375 miles to the north in March, 1957. The line parallels the route of the Iranian railway system which has been badly overburdened, hauling large tonnages, including petroleum products. The 595-mile pipe line was expected to be on stream all the way to Teheran by July, 1957.

Cost of the line was $32 million. The initial link is a 75-mile, 10-inch, former crude line built in 1915 by Anglo-Iranian Oil Company (now British Petroleum Company, Ltd.). It still is in serviceable condition, though it may be replaced later. Construction of the new line from Ahwaz to the Rey Terminal, ten miles south of Teheran, began in 1955. Costain-John Brown, Ltd., of London, was contractor for the 300-mile southern link of the line, with Williams Brothers of Tulsa, Okla., working with the British firm as consultants.

Societe Entrepose of Paris, France, completed the 200 mile northern segment. The route of the line is very difficult, traversing 200 miles of rugged mountainous terrain, 165 miles of hilly country, and 230 miles of desert. From an elevation of 80 feet above sea level at Ahwaz, the line climbs to 7500 feet where it crosses the rugged Zagros Mountain range. There are six pump stations. Seven additional stations to be installed later will increase capacity to 60,000 barrels of gasoline per day.

Two new spur lines were projected to effect more widespread distribution of petroleum products from Abadan. A 200-mile, 6-inch spur from station Number 6, located 200 miles south of Teheran, will be built to Isfahan, former capital of Iran. Another 6-inch spur, 220 miles long, was planned from Teheran to Resht, in northwestern Iran along the southwestern shore of the Caspian Sea. Both spurs would have a capacity of about 20,000 barrels of gasoline per day.

In addition, the Iranian government planned a new 6-inch pipe line from Naft-Shah field to the Kermanshah refinery, which would supplement the current oil flow through an existing 3-inch line previously mentioned. Costain-John Brown was being retained as consultant for the new line in early 1957, and some material for it was being shipped to Iran. In conjunction with the project, the Kermanshah refinery was to be quadrupled in throughput capacity to about 15,000 barrels per day, with a proportionate expansion in pipe line capacity to be effected by the new 6-inch line when completed.

Consortium Activity. Iran was the only Middle Eastern oil producing country not adversely affected by the blocking of the Suez Canal. Though the resulting shortage of tankers was

1956 Production in South Iran, by Fields

FIELD	PRODUCING WELLS, DECEMBER 31, 1956		Workovers Completed on Production Wells, 1956	Number of New Wells Completed During 1956	No. New Wells Drilling, 12-31-56	Average Daily Production, 1956, Bbls./Day
	No. Active	No. Shut In				
Agha Jari	21	1	0	2	3	371,500
Haft Kel	17	3	10	0	0	84,000
Masjid-i-Sulaiman	16	11	0	0	0	39,000
Naft Safid	8	5	0	1	1	21,000
Gach Seran	2	2	0	0	0	13,000
Lali	1	4	0	0	0	7,000
Ahwaz	0	0	0	0	1	0
Total	65	26	10	3	5	535,500

not beneficial to Iran, no serious dislocation was indicated by either production or refining figures while the Canal was blocked.

Iranian oil is marketed in both northern and southern hemispheres, and the marketing scheme, what with many companies participating in the Consortium, provides considerable built-in elasticity. Thus, if access to some markets is cut off or hampered, it is likely that the resulting temporary surplus can be disposed of through adjustments made elsewhere.

Five U. S. companies each have a 7 percent interest in the Iranian Consortium: Standard Oil Company (New Jersey), Gulf Oil Corporation, Standard Oil Company of California, The Texas Company, and Socony Mobil Oil Company.

Nine other U. S. companies jointly own 5 percent interest: American Independent Oil Company, Hancock Oil Company, The Atlantic Refining Company, Getty Oil Company, San Jacinto Petroleum Company, Richfield Oil Corporation, Signal Oil and Gas Company, Tidewater Oil Company, and Standard Oil Company (Ohio).

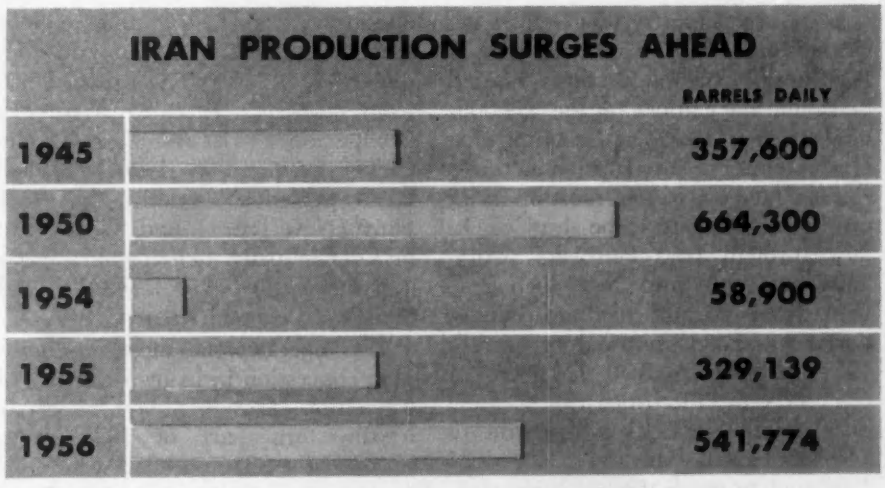
The remaining 60 percent interest is shared by The British Petroleum Company, Ltd., 40 percent; Royal Dutch Shell, 14 percent; and Compagnie Francaise des Petroles, 6 percent.

All companies or groups mentioned were original signatories to the agreement of 1954 with the Iranian Government, and many of them have since transferred their rights to subsidiary companies.

The comprised Consortium operates in the area governed by the agreement, including the known fields in South Iran. The two operating companies are Iraanse Aardolie Exploratie en Productie Maatschappij N V (Iranian Oil Exploration and Production Company) and Iraanse Aardolie Raffinage Maatschappij (Iranian Oil Refining Company), both incorporated in The Netherlands but with home offices in Teheran, Iran. Iranian Oil Participants, Ltd., a British firm headquartered in London also was formed by the Consortium as a holding company governing the shares of the two operating companies, proportioned according to the interests of each member company.

The 1954 agreement effects a partnership between the Consortium and the Iranian Government and its agency, National Iranian Oil Company, owner of the oil reservoirs and of the oil field and refining equipment. The two operating companies of the Consortium are thus in charge of producing the oil within its area and refining it. The oil is sold by subsidiaries of the 17 member companies. In return, the Consortium shares profits equally with the government. National Iranian Oil Company markets within Iran, and carries out all phases of the business outside the Consortium area.

Crude production by Iranian Oil Exploration and Production Company during 1956, put at 195,581,331 barrels, averaged 534,375 barrels daily during the year. Comparing daily rates, the 1956 figures indicate a 63.9 percent increase in 1956 over 1955. The 1956 production total was comfortably above the goal agreed upon between the Consortium and the government in 1954, when 500,000 barrels daily was set for 1956. Production of 637,500 barrels for 1957 appeared to be safely assured by midyear.



Iranian Oil Refining Company charged 85,308,557 barrels of crude oil at the Abadan Refinery during 1956, for an average of 233,083 barrels daily. The increase from 152,000 barrels in 1955 amounted to 53.3 percent in 1956 on a daily average basis. In 1956, the percentage of Consortium-produced oil refined at Abadan was 43.6 percent, as compared with 46.4 percent in 1955.

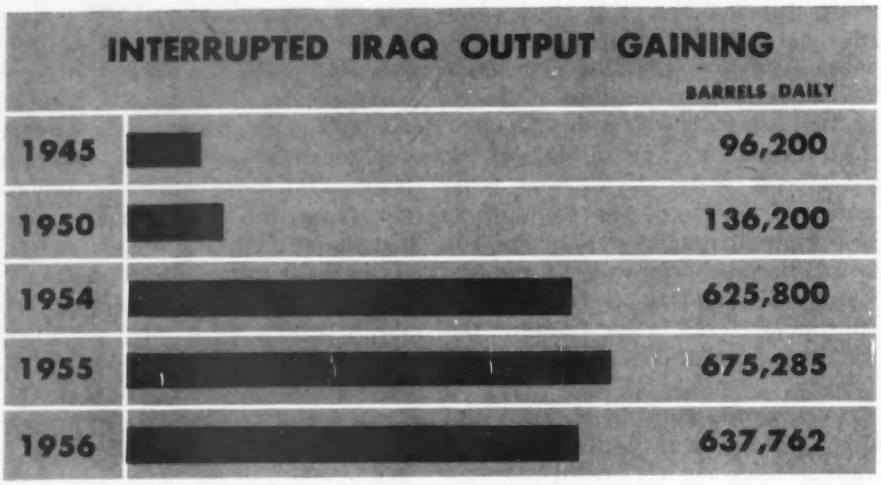
Lali, Masjid-i-Sulaiman, Naft Safid, Haft Kel, Agha Jari, and Gach Seran fields all produced oil in 1956. Lali and Naft Safid, relatively small fields, still were being developed. Haft Kel and Masjid-i-Sulaiman have both passed peak production. The prolific Agha Jari field, biggest 1956 producer, was still being developed and two extension wells were completed, Agha Jari 36 and 38, the latter coming in with probably the biggest potential of any well so far drilled in the field.

A fourth gas separation plant was planned for Agha Jari, and additional pipe lines and other facilities were being built there to bring the capacity of the field from 450,000 to 600,000 barrels per day. This rate will probably represent the maximum efficient rate of production for the Asmari limestone reservoir producing at Agha Jari.

Gach Seran, a shallow field and southernmost of the South Iran crude sources, went on production during 1956 and was yielding 40,000 barrels of crude daily at the end of the year. A drilling program for additional wells in Gach Seran was being instituted. Several production units, each with a capacity of 150,000 barrels per day, and hydrogen sulfide extraction units to improve the quality of the crude, were scheduled to be built at Gach Seran.

During the first five months of 1957, Iranian Exploration and Producing Company produced 101,969,097 barrels for an average of 675,292 barrels daily during the period. At the same time, Iranian Oil Refining Company charged 51,609,954 barrels at Abadan, an average of 341,788 barrels per day. Thus, 50.61 percent of Consortium area-produced crude was being run at Abadan. The biggest month was February, when an average of 735,000 barrels per day was produced and 372,000 barrels daily was refined.

Exploratory work was renewed in 1956 in South Iran after having been virtually dormant since 1951.



Iraq . . . Hopes of record year blasted by Syrian saboteurs' strike at pipe line system.

IRAQ'S OIL industry was well on it's way toward enjoying a record year in 1956 when Syrian saboteurs blasted two pumping stations on the 534,000-barrel-a-day Iraq-Syria-Lebanon pipe line system. The interruption of transmission facilities caused most of Iraq's producing capacity to be shut in. Oil flow through Iraq Petroleum Company's 12-, 16- and 26-32-inch pipe lines from Kirkuk field to Banias, Syria, was partly restored in March, 1957, running at about 220,000 barrels per day. Throughput of these lines was scheduled to increase to 340,000 barrels daily by the end of 1957 and to reach the pre-November, 1956, level of 534,000 barrels per day by April, 1958. Pumping stations in Iraq are now supplying all the power to move the oil, which is flowing through by-passes quickly fabricated around the blasted Syrian pump stations.

Production. Crude production in 1956 totaled 233,420,516 barrels, for an average of 637,762 barrels daily, representing a drop of 39,524 barrels daily, or 5.85 percent, from the 1955 rate (675,285 barrels per day). Production was maintained very well, especially in consideration of the virtual shutoff of IPC's 485,000 barrel-a-day production in November and December due to sabotage of the pipe lines.

Iraq Oil Setup. The entire country is under concession. Four companies, three of them very closely affiliated, operate in Iraq. Iraq Petroleum Company, Ltd., (IPC) has an ownership divided as follows: The British Petroleum Company, Ltd., 23.75 percent; Compagnie Francaise des Petroles, 23.75 percent; Royal Dutch Shell, 23.75 percent; Standard Oil Company (New Jersey) and Socony Mobil Oil Company, 11.875 percent each; and the estate of the late C. S. Gulbenkian, 5 percent.

IPC operates the most productive Iraq concession in its own name. This concession takes in almost all of the northwestern part of the country north of the 33rd parallel, west of the Iranian frontier, east of the Tigris River, and south of the Turkish border.

Two other companies operating in Iraq are IPC subsidiaries:

• Basrah Petroleum Company, second in production in the country, operates almost all of the country south of the 33rd parallel. Its production comes from Rumaila and Zubair fields south of Lake Al Hammar, which are connected via a 125-mile pipe line system, mainly composed of 12-and 24-inch lines, with the Persian Gulf port of Fao.

• Mosul Petroleum Company operates the concession north of the 33rd parallel, west of the Tigris River, bordering on Syria to the west. Its current production stems from several fields along the west bank of the upper Tigris River, which are connected via 12-inch pipe line with the Kirkuk-Banias system and are dependent on it for an export outlet.

Khanaqin Oil Company, Ltd., a British Petroleum Company subsidiary, operates the smallest Iraq concession (Naft Khaneh), producing oil from a field straddling the Iran frontier. The Iranian part of the field is called Naft-I-Shah. Khanaqin shunts its crude through a 40-mile 4 and 6-inch pipe line to the Alwand refinery, operated by the government. Products are sold locally.

Iraq Petroleum Company. IPC produced 160,022,830 barrels of oil during 1956, an average of 437,221 barrels per day, a decline of 52,547 barrels daily from the 1955 average of 489,768 barrels per day, or 10.7 percent below the 1955 rate. After demolition of the Syrian pumping stations on Nov. 2, 1956, production from Kirkuk field was restricted to deliveries to the Iraq government refinery at Dora, near Baghdad.

All IPC production was from Kirkuk field, now 30 years old. Despite completion during 1955 of the pipe line linking Jambur field, 20 miles south of the south end of Kirkuk field, neither Jambur nor Bai Hassan, a 1953 discovery just southwest of Kirkuk, was on export production during 1956.

Total footage drilled last year by IPC was 52,802 feet, representing a 28.71 percent increase over 1955's 41,024 feet. Five wells were completed in 1956, including two oil producers and one dry hole at Bai Hassan and one gas well and one dry hole at Jambur. At year's end, five rigs were working, one each in Jambur, Bai Hassan, and Kirkuk fields, and the other two on wildcat locations. The two exploratory tests were located at Pulkana, 25

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miles southeast of Jambur field, and at Injana, 38 miles due south of Jambur.

Basrah Petroleum Company. Basrah was the only one of four companies operating in Iraq to enjoy an increase in 1956 production as compared with the previous year. Due to increased productive capacity in Zubair and, more recently, in Rumaila fields, Basrah's production has been rising.

And since these two fields are close to the deep-water loading facilities at Fao on the Persian Gulf, the Company is not nearly as vulnerable to pipe line sabotage as are IPC and Mosul. Production during 1956 amounted to 63,756,402 barrels for an average of 174,198 barrels per day, an increase of 24,052 barrels daily or 16 percent above the 1955 rate of 150,146 barrels per day.

Basrah reached its target for 1956 exports from Fao on Christmas Day, when the figure for the year reached 8 million tons. On Jan. 19, 1957, Fao's oil exports passed the 25-million-ton mark, dating from December, 1951, when Basrah Petroleum Company's Fao terminal went into operation. There are four oil-loading jetties at Fao.

Zubair field accounted for slightly more than half of Basrah's 1956 production, with Rumaila supplying the remainder. Two wells were completed, both of them oil producers at Rumaila. A total of 39,200 feet was drilled during the year, representing a steep 45.4 percent decline from the 71,821 feet drilled in 1955.

At the end of 1956, two wells were being drilled, one in Zubair field, and the other at Rachi, a wildcat test located 27 miles west of Rumaila and 20 miles northwest of the Kuwait border. The Rachi well was spudded in June, 1956. Thus there was considerable interest in this region of good Cretaceous possibilities, on both sides of the Iraq-Kuwait frontier.

Mosul Petroleum Company. Mosul produced a total of 7,941,284 barrels of oil during 1956, for an average of 21,697 barrels daily. Compared with the 1955 production of 26,056 barrels per day, last year's rate represented a decline of 4359 barrels daily or a drop of 16.73 percent.

The normal 26,000 barrels daily rate has come in the past two years, from Ain Zalah (19,500 barrels daily) in far northwest Iraq, near the common border point with Syria and Turkey, and from Butmah field, located about eight miles southeast of Ain Zalah (6500 barrels a day). Since Mosul's production is the most thoroughly land-locked, it was hard hit by the destruction of the pipe lines. From Nov. 2, 1956, through the middle of March, 1957, when partial flow was restored through Syria, small amounts of oil were produced at Ain Zalah and Butmah for local use only.

Mosul drilled a total of 36,657 feet during 1956, representing an increase of 9369 feet or 34.3 percent above 1955's total of 27,288 feet of hole. Three wells were completed during 1956 at Butmah as producers. Another producer was completed at Qaiyarah field, located about 70 miles downstream on the Tigris River from Butmah and Ain Zalah. Qaiyarah field is beginning to supply crude oil to an Iraq government bitumen plant. Maximum requirement for heavy crude for this purpose will be 100,000 tons per year.

At the Sasan location, 25 miles southwest of Ain Zalah field, where high-gravity oil was reported to have been found at 5000 feet, a series of tests proved negative and the well was abandoned at a total depth of 9670 feet. Alan 1, located 15 miles south of Butmah field, was abandoned as dry at 9400 feet. Makhul 1, located on the west bank of the Tigris 47 miles south of Qaiyarah field, was drilled to 12,000 feet and abandoned.

Three more wildcat tests, including one each at Ibrahim and Gullar in the far northwest, near Ain Zalah and Butmah fields, and another at Tharthar, 110 miles northwest of Baghdad near the Kirkuk-Banias pipe line, were spudded during 1956 and were drilling at the close of the year.

Khanaqin Oil Company. Khanaqin shut in one of the two wells that had produced oil in 1955. Only one well was reported flowing in the Naft Khaneh field during 1956, with the other shut in. Production during 1956 was estimated at 1.7 million barrels for a daily average of 4645 barrels. Estimated production in 1955 was 3.4 million barrels; hence the 1956 yield represents a 50 percent decline from the previous year. A total of 8828 feet of hole was drilled in 1956, with one previously-spudded test being abandoned at 7000 feet and another being drilled to 4783 feet with no shows and plugged also.

All production is pipe lined to the Government's Alwand refinery.

Refining. Work was under way in 1957 for rapid construction of a lube oil plant at the Iraq government's Dora refinery, near Baghdad, with a capacity of about 4500 barrels of products daily. Foster Wheeler Corporation was the engineering and construction contractor. Foster Wheeler also was granted the contract to expand the Dora refinery from current capacity of 25,000 barrels per day to more than 40,000 barrels.

Among other ambitious government projects that were under consideration at the time of the Syrian sabotage of the IPC pipe lines occurred, reducing revenues of both the company and the government, was a 150-mile natural gas pipe line from Kirkuk field to Baghdad. There, gas could be marketed for both dometsic and industrial uses. The government has been considering all the possible benefits of utilization of natural gas, including a sulfur recovery plant, petrochemicals, LPG, electric power generation, steel rolling mills and other potential industrial applications.

Possible New Pipe Lines. The most pressing problem of Iraq's oil industry is adequate pipe line outlets for its predominantly land-locked crude sources. Even before left-wing elements in Syria caused IPC's lines to be detonated, in violation of previous contracts between the Syrian government and the company, IPC was attempting to reach understandings with both Syria and Lebanon and to be allowed to expand the capacity of its pipe lines to the Mediterranean. Should the political situation in Syria and Lebanon stabilize and relations between the governments of these countries and IPC improve, it may be possible to effect the increases in capacity needed by Iraq.

In addition, it would be practicable to divert the two pipe lines, one 12-inch, the other 16-inch, that formerly moved Iraq oil through Jordan to Haifa northward through Syria and Lebanon to the Mediterranean. Iraq will not allow, for political reasons, these lines to be used at present since the terminus is in Israel.

As the port of Fao becomes more congested with the increased export of crude from Zubair and Rumaila

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fields, and more and more ships ply the lower Tigris-Euphrates to and from Abadan, a new pipe line outlet for Basrah Petroleum Company's output, possibly through Kuwait, becomes more essential. The Shaikh has allowed IPC to conduct a survey through northern Kuwait for a proposed pipe line to a point on the Persian Gulf between Kuwait town and Mina al Ahmadi.

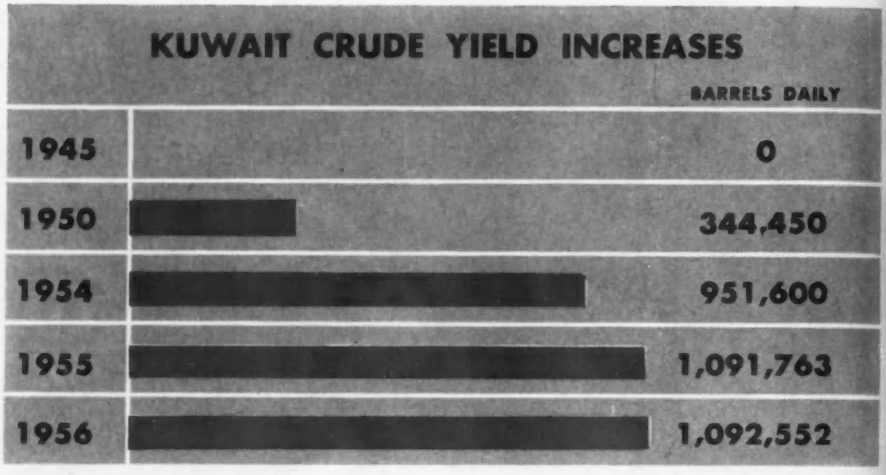
However, Kuwait may have a congestion problem of its own as regards shipping facilities in the near future. And there is a touchy problem of an historic Iraqi claim to Kuwait that works against intimate business relations being established between the two countries.

The largest scale proposal for a pipe line through Iraq, which would be the hub of any large-scale new Middle East pipe line planning was one under consideration by the major international oil companies, including Royal Dutch Shell, Jersey Standard, British Petroleum, Compagnie Francaise des Petroles, Socony and others. The line would traverse the Tigris Valley throughout all or most of Iraq and would terminate at Iskenderun Turkey on the Mediterranean coast by-passing Syria and Lebanon whose governments have proved most difficult to deal with on pipe line matters during the past two years.

The route through southeastern Turkey already had been surveyed and was feasible. The line, if built, probably would be the biggest pipe line project ever attempted. It would have pipe in the order of 38 to 40 inches in outside diameter. Length would be from 1000 to 1200 miles. Cost would approach, if not exceed $1 billion. Capacity of the new system would be around 800,000 barrels per day initially, to be increased later to over twice that much.

The technical problems involved would be great, particularly the matter of construction with pipe of such great size; pumping methods; the problem of mixing high gravity crudes with more viscous ones in a common carrier; and the availability of pipe. But the political problems would be even harder to surmount, for Arab nations, despite their many different individual interests and problems, prefer that oil produced in Arab countries be transported through Arab countries. Turkey and Iran are not Arab countries.

Iraq having the most to gain, will perhaps be easier to deal with than some of its neighbors, as the pipe line as visualized also would be reversible, so that if the Mediterranean terminus were shut off, oil could be pumped in the other direction to outlets on the Persian Gulf. But the many problems to be answered, including antitrust questions that would have to be settled to the satisfaction of any U. S. companies participating in the project, mean that the new pipe lines—so necessary to move expanding Middle East crude output to expanding markets in Western Europe—are issues of future years.



Kuwait . . . 1957 production should reach new high despite tanker shortage during Suez crisis.

RAPID DEVELOPMENT of Kuwait's production, reserves, and refining capacity continued in 1956 and 1957. The small sheikdom, whose area is only 1940 square miles, has greater crude oil reserves than any other single nation on earth, despite being roughly the same size as the Island of Trinidad.

Crude production increased slightly during 1956 to 399,874,491 barrels for a daily average of 1,092,552 barrels per day. The total represented a 0.347 of one percent boost over the 398,493,597 (1,091,763 daily) barrels produced in 1955. The increase would have been considerably larger except for the blocking of the Suez Canal and the resulting tanker shortage. Average production during the first five months of 1956 was 1,175,037 barrels daily, considerably above the average for the year.

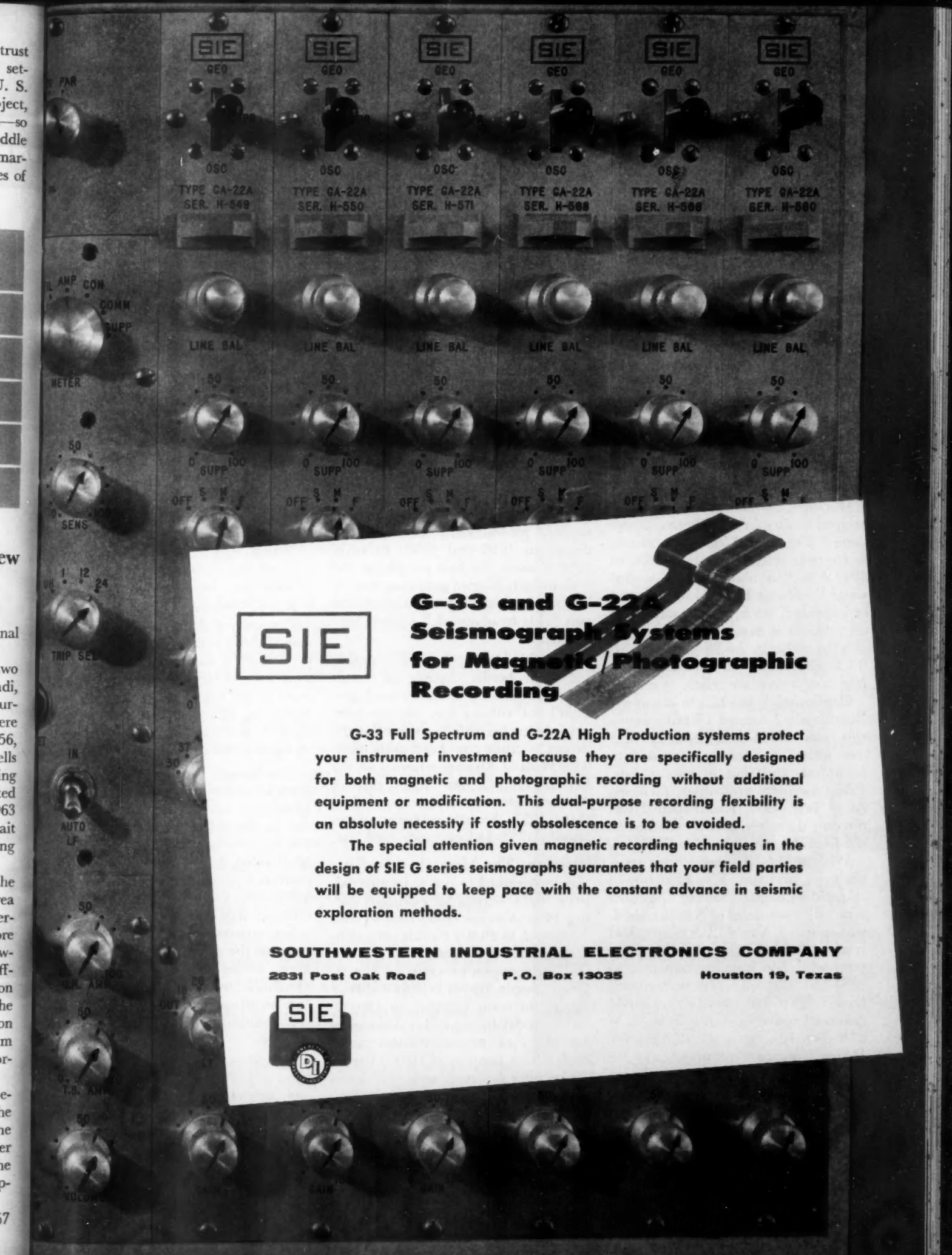
At one time last November, tanker loadings at Mena al Ahmadi had decreased from the normal eight daily to two per day.

Prospects. In 1957, indications were that Kuwait production would exceed that of any previous year, despite the tanker shortage that prevailed during early 1957 with the Suez Canal blocked.

All 1956 production was from two fields, Burgan and Magwa-Ahmadi, covering about 86,000 and 52,000 surface acres, respectively. There were 211 wells on production during 1956, all of them flowing. Twenty-five wells were drilled in the two fields during the year, all of them being completed as oil producers. A total of 136,963 feet of hole was drilled in Kuwait during 1956. Four wells were drilling at the close of the year.

Kuwait Oil Company, Ltd., has the concession covering the territorial area of the country, certain islands appertaining to Kuwait, and the offshore area extending six miles beyond low-water mark into the Persian Gulf offshore from Kuwait. This concession was validated in 1951 to extend to the year 2026. Kuwait Oil is owned on a 50-50 basis by The British Petroleum Company, Ltd., and Gulf Oil Corporation.

As of mid-1957, no international decisions had been made regarding the extent of offshore areas which come within the jurisdiction of the Ruler of Kuwait. Hence, reports that the Shaikh would grant concessions ap-



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plying to offshore areas beyond the six-mile limit apparently were premature.

Exploration. Exploration was continuing actively in 1957, following the discovery of a major oil field at Raudhatain in northern Kuwait in 1955, and completion of a confirmation test in 1956. Raudhatain 1 was spudded late in 1954 and completed late in 1955 in northeastern Kuwait, about 15 miles south of the Iraq border.

The location is 50 miles north-northwest of the north end of Magwa-Ahmadi field and about 35 miles south-southeast of the Zubair oilfield in Iraq. A net thickness of 1500 feet of effective oil sands was reported from 7370 to 10,300 feet. The upper sands were reported to be correlative with the Burgan sands, highly productive farther south in Kuwait, and lower pays discovered were confirmed to correspond with those producing in nearby Iraq, at Zubair.

However, the new field may not be as good a discovery as Burgan, where there is 800 to 1000 feet of oil column in Cretaceous sands at about 3600 to 4800 feet. The reason is that several water levels were found at Raudhatain in individual sands, so that water-free completions in some of the reservoirs may be difficult. At Burgan, with its thick, continuous oil column, water-free completions are relatively easy.

Confirmation test to the discovery, Raudhatain 2, located 1.8 miles southeast, was drilled to a depth of 9695 feet with 7-inch casing cemented to 8778 feet, and shut in during July, 1956, awaiting production facilities. As of July, 1957, Raudhatain 2 was the only definitely-known extension to the field discovered by Raudhatain 1.

Wildcat tests of other seismic prospects in northern Kuwait followed in rapid succession. Sabriya 1, located nine miles southeast of Raudhatain 1, was spudded Aug. 11, 1956, and had reached 8450 feet by the end of the year, with 7-inch casing cemented at 8437 feet. The test was to be deepened later to explore the Zubair sands. Sabriya 1 found oil, but with water at a higher level than at Raudhatain. Hence, it was not certain whether the well was an extension or a new, separate discovery.

Bahra 2, located 10½ miles south of Sabriya 1 and about eight miles inland from the north shore of Kuwait Bay, has been drilled to 8488 feet with 7-inch casing cemented at 7789 feet and shut in by early 1957. Though an oil producer, Bahra 2 was not expected to be as productive as some of the other discoveries.

Though considerable drilling will be required to define the limits of the new north Kuwait field or fields, it was clear that a highly productive Cretaceous trend carries from Wafra field in the Neutral Zone north through Burgan and Magwa-Ahmadi, thence slightly northwest on a gentle arc through Bahra 2, Sabriya 1, and Raudhatain, to Zubair and Rumaila fields in southern Iraq. The sands are often thick, usually with excellent reservoir characteristics. Total thickness of the Cretaceous section thickens to the north.

Kuwait Oil Company was reported bringing in a second rig for exploratory and evaluation drilling in northern Kuwait. It was expected that the company would be running four rigs in the area by the end of 1957.

Expansion of all facilities to increase production, transmission, and loading capacity for south Kuwait crude continued in 1956 and 1957. In early 1957 Kuwait Oil had completed the 11th Burgan-Magwa gathering station, increasing producing capacity of the two fields to almost 1.5 million barrels daily.

Kuwait's loading facilities—including eight berths capable of simultaneous use by tankers and five additional submarine berths—were nevertheless becoming congested as the export of crude continued to increase. The Mina al Ahmadi terminal on the Persian Gulf a few miles east of Ahmadi field was being expanded in early 1957 through addition of an additional 32-34-inch crude pipe line.

Refining. The Mina al Ahmadi refinery continued to run at its approximate 30,000 barrels daily capacity during 1956. Average crude runs to stills amounted to 28,804 barrels per calendar day during the year.

The expansion program for the refinery, begun in mid-1956 and intended to boost capacity to 190,000 barrels a day by the end of 1957, continued. Two new distillation units, each with a capacity of 80,000 barrels daily, were designed and were being procured by E. B. Badger and Sons of England, the same firm that originally built the refinery at Mina al Ahmadi. International Bechtel, Inc., of San Francisco, and George Wimpey and Company, Ltd., of London, were constructors for the expansion program.

Primary purpose of the refinery has been to satisfy Kuwait's domestic oil products needs, which are small, and to provide bunker and diesel fuels for tankers. Expansion of Kuwait shipping, both in import and export categories, has necessitated the increase in refining capacity. Each new distillation unit will include a gasoline stabilizing unit, and will take a distillate cut exceeding 20 percent, in keeping with the stress on middle distillates, marine diesel and furnace fuel oils including tanker bunkers.

Government Use of Oil Revenues. The Ruler of Kuwait, His Highness Shaikh Sir Abdulla Al Salim Al Subah, now is over 64 years old. The succession to the rulership of Kuwait generally is more or less settled before the death of a ruler. The choice of a Shaikh is made from among the members of the ruling family (the Subah family).

Hence, the current political stability in Kuwait and the policies of development of the country to the benefit of all citizens is expected to continue.

Kuwait Oil Company's profits are split equally with the Kuwait government. About one third of oil revenues to Kuwait is earmarked for current local expenditure, a second third is spent at the ruler's discretion, and the remaining third is invested by the Kuwait Investment Board, which is set up in London.

The Kuwait people benefit through good salaries paid to government employes, now becoming more numerous, and to the police and security forces. Public housing programs are being accelerated. Education, medical care, insurance, and many social services are offered without charge. The government has purchased land from urban property owners to resettle some of the population in residential areas. Other development programs are continuing, particularly one to assure an adequate supply of fresh water—a constant and severe problem in Kuwait.

Kuwait is trying to modernize itself, after so many dormant centuries. Sewage pipelaying, street-lighting, power generation, schools, roads, and highways are but a few of the public works now under rapid construction, thanks to revenues from the nation's oil industry.

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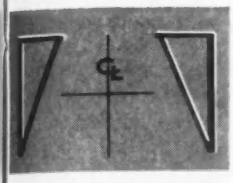

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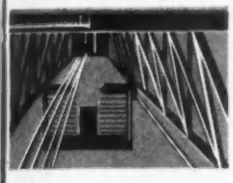

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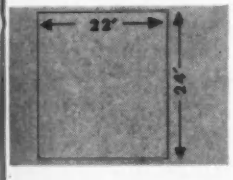

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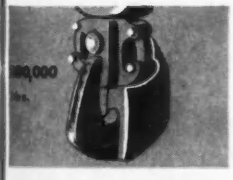

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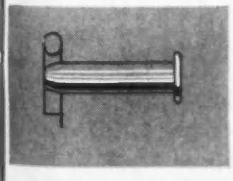

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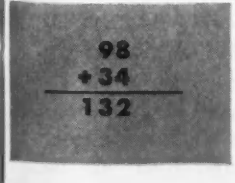

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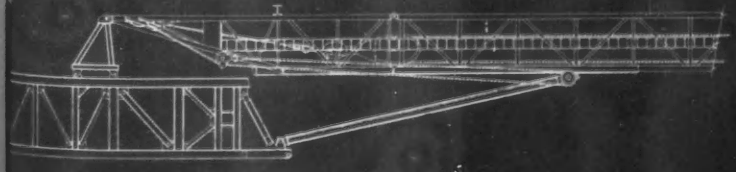

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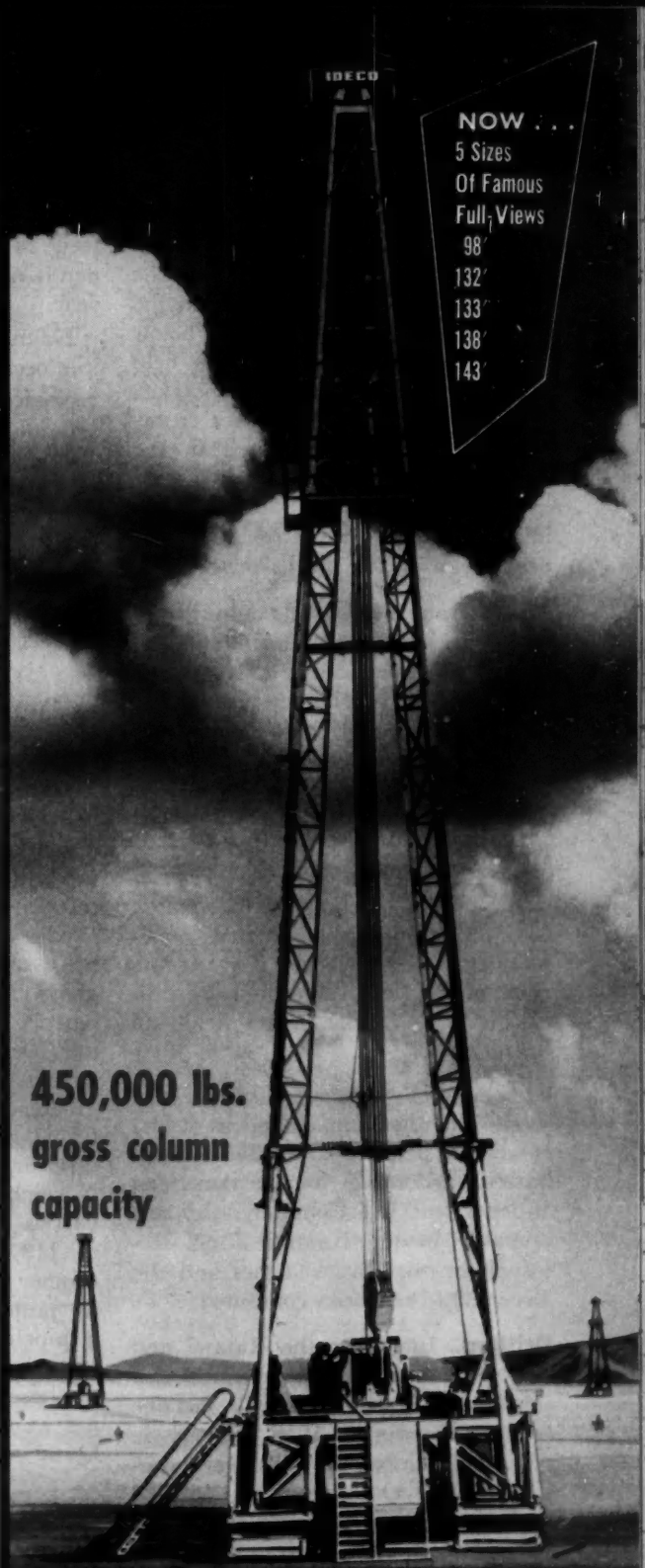

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Neutral Zone . . . Ratawi completions in Wafra field highlight 1956 activities.

MAJOR DEVELOPMENT of Neutral Zone operations during 1956 was the development of production from the Ratawi oolitic limestone horizon below the Burgan sand of the Wafra field and the shallow Eocene horizon, which produces heavy gravity crude.

The two wells completed in the Ratawi resulted in a total crude yield of 126,913 barrels; the 15 completions in the Eocene accounted for crude production of 260,156 barrels.

Production. Total crude output from the Wafra field last year amounted to 11,724,585 barrels, or a daily average of 32,034 barrels. This was tantamount to a total of 2,676,816 barrels—or 7990 barrels daily—more than production during the previous year of 8,847,769 barrels, or 24,240 barrels per day.

The Burgan sand, Wafra field's principal producing horizon, accounted for 11,337,516 barrels last year, or almost 31,000 barrels per day. At the close of the year, 56 wells were producing wells in the Wafra field—all flowing.

Reserves. Proved recoverable crude reserves of the Burgan sand as of December 31 amounted to 250 million barrels, according to the American Independent Oil Company, the sole operator in the Neutral Zone. Reserves for the Ratawi zones and the Eocene had not been computed.

Drilling. Including the Ratawi and Eocene completions, American Independent drilled 28 field wells and one wildcat test during 1956. Twenty-six of the development wells were producers. The exploratory test, drilled to 4529 feet approximately eight miles northeast of the Wafra field, was abandoned with no shows reported in either the Eocene or Burgan sand horizon. Four wells were drilling at year's end.

During the previous year, 13 development wells were completed and two wildcats were drilled.

In 1956, 83,985 feet of hole was drilled, 25,231 feet more than was recorded in 1955. Due to the increased number of completions last year, however, the average depth per well amounted to slightly more than 2896 feet, as compared with an average depth of 3917 feet in the preceding year.

No major construction of new facilities occurred during the year, and no geological or geophysical exploration activities were reported.

While natural gas reserves had not been calculated, natural gas production last year amounted to approximately 4.1 billion cubic feet.

American Independent is owned by a group of ten U. S. independent producers and, on behalf of itself and Pacific Western Oil Corporation, holds a concession to the sheikhdom of Kuwait's undivided half interest in the 2600-square-mile desert region. Pacific Western holds the concession from Saudi Arabia to its half of the zone.

Qatar . . . Production from country's lone field continues to show increase.

QATAR PETROLEUM COMPANY, Ltd., affiliate of Iraq Petroleum Company, continued to coax an increasing amount of crude oil from Qatar's only field, Dukhan, during 1956. Production totaled 45,345,086 barrels, for a daily average of 123,594 barrels during the year.

This 1956 daily rate represented a boost of 9052 barrels, or 7.9 percent above that of 1955, when 114,542 barrels were produced per average day for a total output of 41,807,830 barrels. The increase would have been greater during 1956 had the Suez Canal not been blocked. Due to the resulting tanker shortage, output in November, 1956 fell to only 89,416 barrels daily, but recovered quickly to 118,107 barrels per day in December and to 126,125 barrels daily in January, 1957. Dukhan's output is pipelined across the Qatar peninsula via 14½- and 20-inch pipe lines to the eastern shore for tanker loading at Umm Said, 60 miles distant. Qatar crude is the easternmost of Persian Gulf crudes by geographical location, and this factor probably helps to explain its quick recovery from adverse effects of the Suez crisis.

A decline in drilling rates occurred in Qatar during 1956, with five wells, including only one producer, being completed for a total of 39,868 feet of hole. One well was drilling at the end of the year. By comparison, in 1955 nine wells were completed, six as producers, and 54,720 feet of hole was drilled.

While Qatar Petroleum Company has development rights on the mainland, the Royal Dutch Shell Group, represented by Shell Company of Qatar, Ltd., has concession rights offshore pursuant to a 1952 agreement. An offshore rig operating from a $2.5 million, 1900-ton mobile steel platform drilled two tests before being wrecked by a sudden change in wave action while being moved to the third location late in December, 1956. The first test was drilled about three miles offshore from Doha on the east coast of the peninsula and was abandoned at 6700 feet. The second test, drilled in 1956 before the rig was lost, was drilled to 11,800 feet at a location 40 miles off the east coast of Qatar.

The third test was to be about 30 miles northeast of the second, and about 70 miles from shore, in 80 feet of water. Royal Dutch Shell was reported to have placed an order for a new mobile drilling platform. The new platform was expected to be ready for use in the Persian Gulf by the end of 1958 and thereafter may be used by other Shell group members in other parts of the world.

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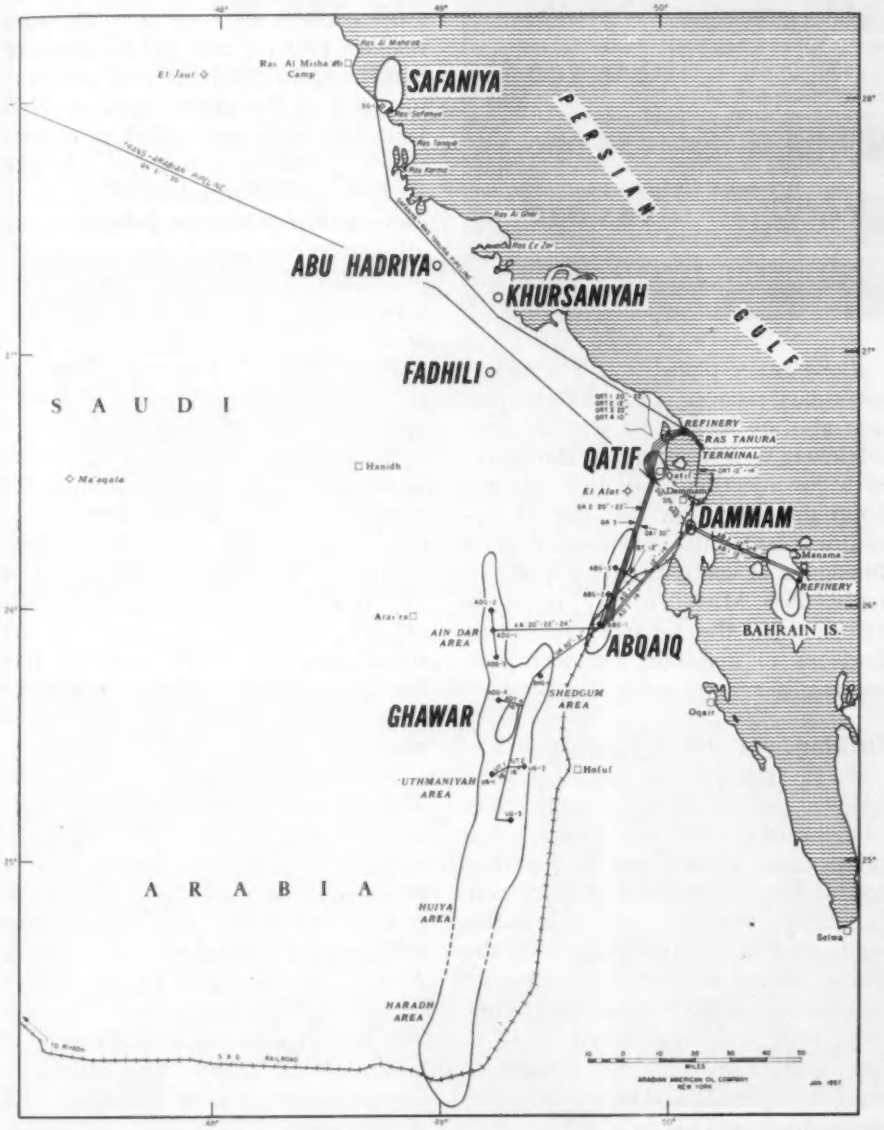


Saudi Arabia . . . Aramco continues expansion; Suez strife cuts into production total.

ARABIAN AMERICAN OIL COMPANY continued to expand oil operations in every phase of its activities during 1956 in Saudi Arabia. Production had to be curtailed in November and December with the blocking of the Suez Canal. And the continuation of the blockage until April, 1957, was expected to cause Aramco's production. This year to decrease somewhat from its all-time peak in 1956. King Saud's temporary ban on oil shipments to Britain and France also contributed to the decline.

During 1956, refinery runs at Ras Tanura were down slightly from the previous year. Crude reserves were increased with the discovery of the Khursaniyah field, on the Persian Gulf coast between Dhahran and Safaniya. Construction of the 142-mile, 22-inch crude oil pipe line from Safaniya field to Ras Tanura was completed in April, 1957, and the field was put on production for the first time since discovery in 1951. Twenty new wells were drilled during 1956, including 15 new oil producers.

Production. Total crude production during 1956 amounted to 360,923,384 barrels for a daily average of 986,129 barrels. This was an increase of 21,088 barrels daily over the 1955 average. Aramco had 164 wells capable of immediate crude production at the end of last year, compared with 154 a year earlier. Some wells were shut in due to the over-all reduction late in 1956, so that 114 wells actually were producing oil at year's end.

Ghawar field, more than 140 miles long, the biggest oil field area-wise in the world, led other Saudi Arabian producing oil fields in volume during 1956, as it has since 1953. Average daily production during 1956 from Ghawar was 620,389 barrels, representing 62.91 percent of the total.

During the year, production from Abqaiq field averaged 287,061 barrels per day, Dammam 47,001 barrels, and Qatif, 31,678 barrels. Safaniya, Abu Hadriyah, Fadhili, and the newly-discovered Khursaniyah field were shut in during 1956, but Safaniya was put on production in April, 1957, upon completion of the new pipe line to Ras Tanura.

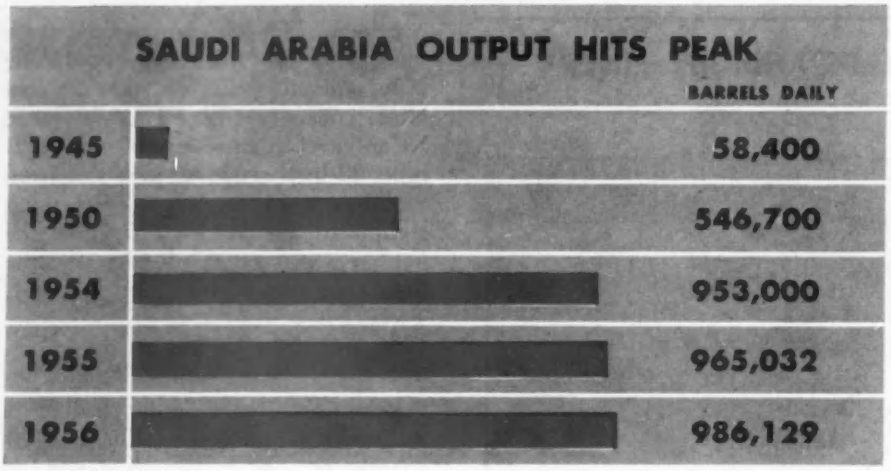
Details of the status of wells by individual fields are found in an accompanying table.

During the first ten months of 1956, production exceeded 1 million

Status of Wells in Saudi Arabia at End of 1956

FIELD	Number Wells Producing	Shut In or Standing	Observation	Injection	Suspended	Abandoned	Drilling	Total
Ghawar:								
'Ain Dar	44	8	2	0	0	1	1	56
Shedgum	11	0	1	0	0	1	0	13
'Uthmaniyah	33	10	3	0	1	2	0	49
al-Hawiyah	0	1	1	0	0	0	0	2
Haradh	0	7	1	0	1	0	0	9
Total Ghawar	**88**	**26**	**8**	**0**	**2**	**4**	**1**	**129**
Abqaiq	42	22	2	6	0	1	1	74
Dammam	29*	1	1	0	0	10†	1	42
Qatif	8	2	1	0	1	1	0	13
Safaniya	0	18	1	0	0	0	1	20
Khursaniyah	0	1	0	0	0	0	1	2
Abu Hadriyah	0	1	1	0	0	2	0	4
Fadhili	0	1	0	0	0	0	0	1
Totals	**167**	**72**	**14**	**6**	**3**	**18‡**	**5**	**285‡**

Footnotes: * Includes three gas wells. † Includes two gas wells. ‡ Excludes dry wildcats drilled at al-'Alah, al-Jauf, Ma'gala, and Stratigraphic Well, which would bring "abandoned" total to 22 and grand total to 289.



barrels daily as anticipated. Reduction in November and December, owing to international political reasons, amounted to about 32 percent.

In the mammoth Ghawar field, three wells in the 'Ain Dar area and eight wells in the 'Uthmaniyah sector were completed during 1956. In November, Ghawar production was further enhanced by the completion of 'Uthmaniyah gas-oil separator Plant 3, the eighth gas-oil separator (GOSP) in Ghawar field.

During the first five months of 1957, crude production in Saudi Arabia totaled 126,874,331 barrels for a daily average of 840,227 barrels per day, a 19.20 percent drop from the same period in 1956 on a daily basis. However, the May, 1957 total was 34,078,648 barrels, or 1,099,311 barrels daily for the month, representing a 1.96 percent decrease from the 1,121,298 barrel-a-day rate of May, 1956. Clearly, Saudi Arabian production was returning to normal by mid-1957.

Conservation. At Abqaiq field, the gas-injection plant caused a daily average of 146.3 MMcf of casinghead gas to be returned to the producing horizon in the top of the structure. Supplementing the older gas-injection program, water injection began in the north end of Abqaiq field on Feb. 7, 1956. By the end of the year, about 40,000 barrels of water were being injected daily through three wells.

Additional facilities were planned, at an expected cost of $3.5 million for the water injection program at Abqaiq to boost daily injection rates to 300,000 barrels. As a result of the secondary recovery program at Abqaiq, ultimate recovery of both oil and gas are being increased.

Long-range plans for a $33 million secondary recovery program for Ghawar also are well under way. Aramco engineers were working on the design of a gas-injection plant to utilize gas from the four 'Ain Dar gas-oil separator plants and from another at Shedgum. It was expected that eventually, 200 MMcf a day could be returned to the Ghawar producing horizons to maintain reservoir pressures.

Drilling. In 1956, Aramco drilled 124,713 feet of hole in deep tests. Fifteen out of 20 deep wells completed during 1956 were completed as oil producers, including one wildcat test at Khursaniyah. Of the five nonproducers, two were water injection wells at Abqaiq, and three were dry holes. Eleven of these 15 oil wells were completed in Ghawar, including eight at 'Uthamniyah and three at 'Ain Dar. Two oil wells of these 15 were completed at Abqaiq. A previously-suspended test at Alru Hadriyah was abandoned. One of the Ghawar producers, 'Uthmaniyah 44, was completed at a depth of 6896 feet in only 37 days, a record for the field.

At the end of 1956, five drilling rigs were operating, one each at Khursaniyah, Dammam, Safaniya, Abqaiq, and 'Ain Dar. A workover rig also was active in 'Ain Dar. A deep test was spudded in October, 1956, in the Dammam field to determine if commercial gas deposits occur below the oil-producing zones.

Aramco made a major discovery at Khursaniyah, located 84 miles northwest of Dhahran near the coast on a very pronounced structure said to have at least as much structural closure as Abqaiq field. At Abqaiq, there is about 1300 feet of closure on the top of the Arab zone.

In mid-1956, on a drillstem test of the top of the Arab zone of the Jurassic from 5954 to 5976 feet at Khursaniyah 1, the well flowed at the rate of 2200 barrels daily of 32 gravity sour crude, with surface pressure reading 800 psi and gas-oil ratio of 340. In early July, the well was coring, still in the Arab zone, at 6168 feet. The well was drilled to a total depth of 7612 feet by Nov. 27. The *A, B, C,* and *D* members of the Arab zone and the Middle Jubailah zone all were proved productive, aggregating about 300 feet of net pay in intervals between 5900 and 6500 feet of depth.

Kursaniyah 1 was completed in the Arab D zone. The deeper Hadriyah and Fadhili zones were tested with negative results. A second test, Khursaniyah 2, located four miles northeast of the discovery well was begun late in 1956. It ran lower than expected, and was abandoned as a dry hole by mid-1957. The Khursaniyah structure appeared to be steep sided and more rounded, like Dammam, rather than more elongated, from north to south, like Abqaiq.

One rig was being kept in the Khursaniyah area, drilling semi-wildcats, during 1957. The rig drilling the deep test at Dammam was expected to be shut down after completing the hole. Another rig was drilling water-injection holes at North Abqaiq, and a fourth rig was working in the 'Ain Dar area of Ghawar. The fifth rig, mounted on the drilling barge Queen Mary, was drilling a development well at Safaniya field during early 1957.

In April, 1957, the Queen Mary was expected to be moved to a location at Manifa, a short distance offshore in the Persian Gulf about midway between Safaniya and Khursaniyah.

In late March, 1957, Aramco announced that 'Ain Dar 56, located 12 miles north-northwest of the northernmost well in the 140-mile long Gwahar field had found oil. The well was drilled to a total depth of 7325 feet and was completed in the Arab *D* member at 7120 feet as an apparent extension to Ghawar field.

Exploration Parties. Hence, Aramco's exploratory drilling during the past year has shown spectacular results. Other less tangible modes of exploration were continued, to seek

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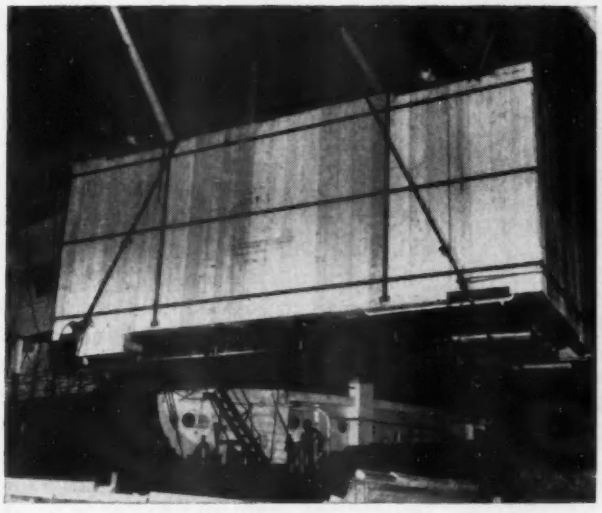

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and evaluate future drilling prospects. Eight exploration parties were active in Aramco concession areas during 1956, except during the two hottest summer months, when such work is suspended. Four seismic parties, three structure drill crews, and one combination gravity-magnetic party were used.

Exploration in the vast Rub al Khali (Empty Quarter) desert area was accentuated. One structure drill party drilled widely-spaced holes with two rotary rigs in service part of the time and with at least one rig working at all times while the crew was in the field. The holes provided basic subsurface data, and some of them were completed as water wells for seismic operations. The southwestern and western parts of the Empty Quarter were covered in this operation. The first seismic party to enter this area followed the structure drill team.

In the central part of the Rub al Khali, one seismic party was in operation, and a gravity-magnetic team conducted reconnaissance work in the eastern part of this vast desert area.

One seismic party worked on structural delineation of Abu Hadriyah and Khursaniyah fields, and another in the northern Summan (Gravel Plains) area. Also in the far north and west central sectors, two structure drill parties, utilizing both rotary and cable tool rigs, gathered basic subsurface data and completed some of the holes as water wells.

Pipe Lines. Aramco expanded pipe line facilities to a peak capacity of 1.2 million barrels daily during 1956, and extensive increases were scheduled for completion in both 1957 and 1958. In 1956, the most important addition was the completion of a third pipe line, 44 miles long, 30-32 inch O.D. from Abqaiq to Qatif Junction. The new $5.1 million line began operating on Sept. 27 with a capacity of 330,000 barrels of crude oil daily.

A new extension of the 'Uthmaniyah-Abqaiq pipe line to the new 'Uthmaniyah GOSP 3 was completed at the same time the plant was opened boosting Aramco's producing capacity by another 100,000 barrels a day. New crude oil gathering lines connecting new wells in Abqaiq and Ghawar to gas-oil separator plants were also completed to increase capacities.

A new pumping unit at Wari'ah was installed at the end of 1956, powered by a 5000-hp remotely controlled gas turbine, boosting Aramco's capacity to deliver crude into the Trans-Arabian pipe line system. Another similar unit was scheduled for construction during 1957 at Tufaih, 37 miles from Qatif Junction along the pipe line to Nariyah and Qaisumah.

Early in 1956, construction of the Safaniya-Ras Tanura crude pipe line, a 22-inch line spanning 142 miles, was commenced, and the job was completed in April, 1957. International Bechtel Brothers, Inc., of San Francisco, was the contractor for the project, which cost $11 million for the line and $10 million more for attendant facilities.

The line initially was capable of delivering 50,000 barrels of crude daily from offshore Safaniya field to Ras Tanura.

However, with completion of the gas-oil separator plant at Safaniya and other facilities, production and transmission of 125,000 barrels daily by July 1957 was expected. It was planned to install a second pump station at the approximate mid-point of the line, equipped with pumps aggregating about 5000 hp, to permit a maximum rate of 190,000 barrels daily by mid-1958.

Safaniya, the biggest marine offshore oil field yet proven anywhere in the world and a 1951 discovery, is the first offshore production found in the Persian Gulf. As of April, 1957, two wells had been completed onshore and 20 offshore in waters up to 45 feet deep. At that time, a 28-mile network of six-inch submarine lead lines had been connected to a twelve-mile 16-inch main gathering line to enable the offshore wells to go on production.

Production is from about 5000-5600 feet in two Cretaceous horizons, called the Zubair and Bahrain zones. The current market situation causes the crude from the Bahrain zone to be more in demand. It contains no H_2S as produced, is paraffinic, has a gravity of 27, a high fuel oil yield and a considerably lower gasoline, kerosine, and diesel oil yield than other Arabian crudes. The recently-increased worldwide demand for fuel oil has made it desirable to put the Bahrain zone of Safaniya on production.

Natural gas from the gas-oil separator plant at Safaniya is used for fuel for three 900-hp centrifugal pumps used to move the crude through the line. Pumps used in the midpoint pump station to be built later will probably burn crude oil, treated with necessary corrosion inhibitors.

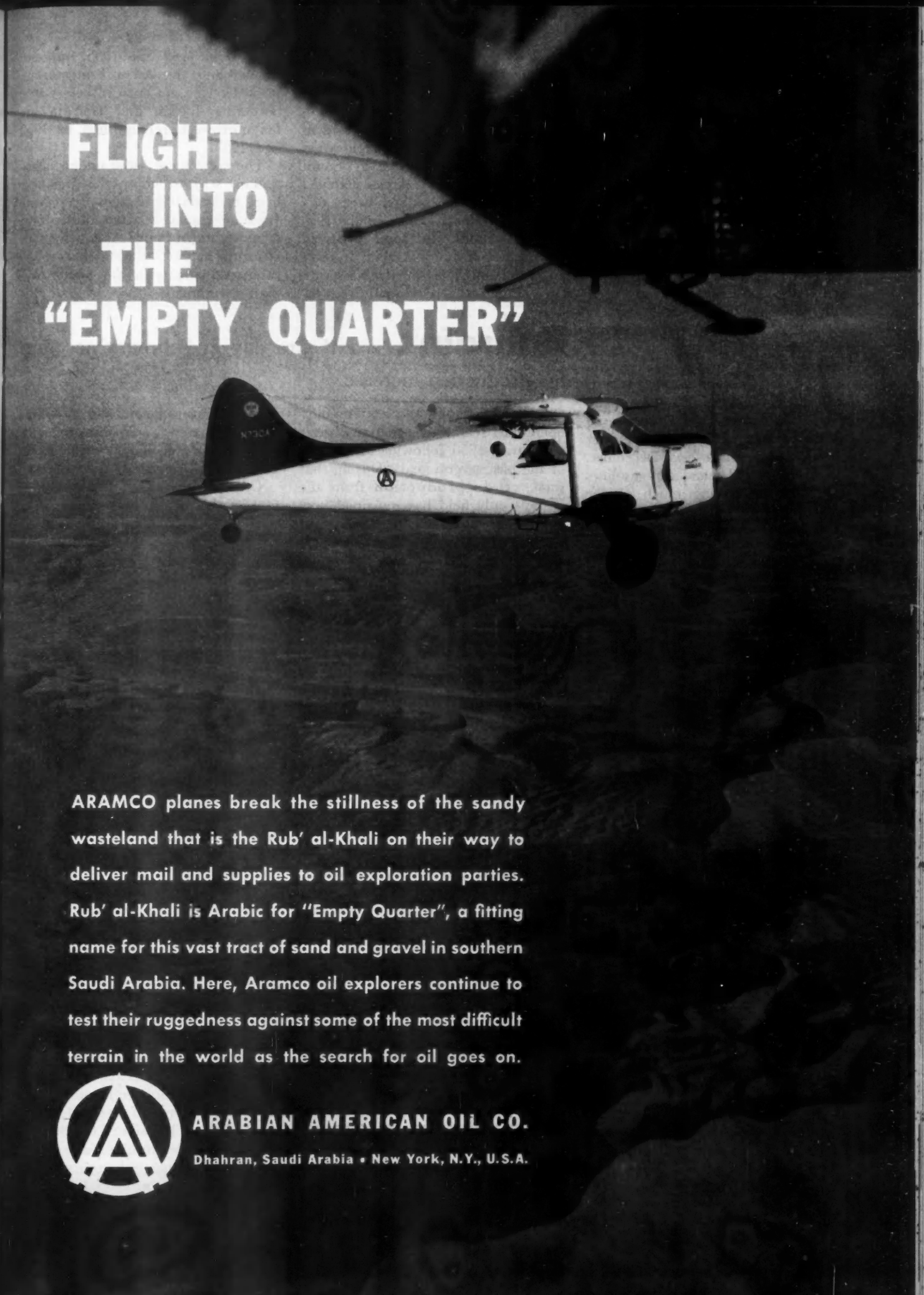
Crude production from Safaniya field began in mid-April, 1957. The first shipment of Safaniya crude was loaded at Ras Tanura May 5.

Trans-Arabian Pipe Line Company. Tapline continued to deliver crude to the Sidon, Lebanon, terminal at rates exceeding 320,000 barrels per day. During the first 11 months of 1956, a daily average of 329,215 barrels was delivered, as compared with an average of 323,256 barrels per calendar day during 1955. During the first five months of 1957, Tapline delivered 51,097,070 barrels to Sidon for an average of 338,391 barrels daily. This rate is almost 4 percent above the daily rate for the same period in 1956. Average daily deliveries of 380,038 barrels in May, 1957, represents a new high for Tapline.

Installation of auxiliary pumping units to boost Tapline's capacity to 435,000 barrels daily by January, 1958, was proceeding in mid-1957. The program was first announced in May, 1956. The new facilities, to be located in Saudi Arabia, Jordan and Lebanon, will cost $14 million. Unattended radio-controlled portable auxiliary pumping units were being installed by mid-1957. Locations to be so served are midway between existing pump stations at Qaisumah, Rafha, Badanah, and Turaif in Saudi Arabia. The most westerly unit was to be located at Qaryatain in Jordan, and a fifth unit was to be added to facilities at Turaif.

Four portable vans were to comprise each pumping unit, complete with foundations, manifolds and a radio tower. The pumps will be remotely controlled from the main stations by radio. One van will contain a 5000-hp two-shaft combustion gas turbine, fueled by crude oil. One turbine unit had been installed in the Trans-Arabian pipe line system by mid-1957, and two more were scheduled to arrive in Saudi Arabia at about the same time.

Initial tests on the first turbine were encouraging. Heretofore, Tap-



ARAMCO planes break the stillness of the sandy wasteland that is the Rub' al-Khali on their way to deliver mail and supplies to oil exploration parties. Rub' al-Khali is Arabic for "Empty Quarter", a fitting name for this vast tract of sand and gravel in southern Saudi Arabia. Here, Aramco oil explorers continue to test their ruggedness against some of the most difficult terrain in the world as the search for oil goes on.

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line transmission has been entirely powered by diesel engines, and new temporary diesel units installed early in 1957 helped increase Tapline's capacity by about 17,000 barrels per day. However, the temporary diesel booster pumps were scheduled to be discontinued when the new permanent turbine installations have been completed.

Refining. In 1956, total crude charged at the Ras Tanura Refinery aggregated 72,662,690 barrels for a daily average of 198,532 barrels. Thus, 20.13 percent of indigenous production was refined in Saudi Arabia during the year. The 1956 throughput represented a decrease of 4678 barrels daily or 2.3 percent below the 1955 level. The drop can be attributed to the blocking of the Suez Canal in November and December. Decline in the demand for gasolines and kerosines during much of the year caused the refinery to run more heavy crude from 'Uthmaniyah and the Arab C zone at Qatif, since these crudes give a heavier yield of fuel oil, and less kerosine and gasoline.

Crude oil throughput at Ras Tanura during the first five months of 1957 amounted to 30,324,173 barrels, for an average of 200,822 barrels per calendar day, down 8.04 percent from the 218,374 barrels per day rate during the first five months of 1956.

A new hydrofiner, slated for early 1957 completion, was under construction at Ras Tanura. The new unit was to process and sweeten 15,000 barrels of diesel oil per day. Engineering and construction contractor for the project is Lummus Company.

Tanker Loadings. At Ras Tanura terminal, 1653 tankers loaded crude oil, refined products, or bunker fuel during 1956, for a decrease of 105 from the previous year. The drop was due to the shortage of tankers owing to the blocking of the Suez Canal.

The south pier of the terminal at Ras Tanura was extended by 300 feet at a cost of $3.3 million to accommodate supertankers.

New Camp. Aramco completed its new permanent community at 'Udhailiyah, near the center of Ghawar field, late last year. The new camp will serve as base of operations for 'Uthmaniyah, al-Hawiyah and Haradh areas of the Ghawar field. Location is 90 miles southwest of Abqaiq.

New Concession? Japan Export Petroleum Corporation was reported to have obtained provisional exploration and development rights in Saudi Arabia in mid-1957. Areas involved are said to be 2 million acres offshore from Saudi Arabia in the Persian Gulf, and also some areas in the interior of Saudi Arabia. Interior areas that might be involved also are two large tracts relinquished by Aramco in 1949 and 1955, opposite Yemen and the Aden Protectorate, respectively; and two other areas, bordering Jordan and Iraq in the far northwest, relinquished in 1952 and 1955.

The agreement, still under negotiation, was to allow the Japanese firm, backed 100 percent by private Japanese capital, to carry out its own oil program in Saudi Arabia without government participation sharing any profits equally with the Saudi Arabian government.

Bahrain . . . Extra day in February accounts for production increase.

DRILLING, PRODUCING and refining operations remained essentially status quo during 1956, following the pattern of the past several years. During that time, crude production from the island's only field has remained very close to 30,000 barrels per day, and refinery runs at the Sitka refinery have stayed close to the capacity of 203,700 barrels daily. Bahrain Petroleum Company, Ltd. (Bapco), a Caltex group member, operates production and refining.

Total crude production during 1956 was 11,013,702 barrels, an average of 30,092 barrels per day, 32,165 barrels more than the total in 1955. Primary cause of the increase was the additional calendar day, February 29, in 1956. On a per-calendar-day basis, production in 1956 increased by less than 1 percent as compared with the 30,086 barrels per day rate during 1955.

At the end of 1956, Bapco had 130 oil wells on production, all flowing. Four others were shut in. In addition, four gas wells were being produced. No gas wells were shut in. The gas was being used for repressuring operations in the oil sands.

Drilling. Bapco drilled 21 development wells during 1956, all being completed as oil producers. Total drilling footage involved in this work was 50,510 feet. The 1956 drilling totals represent an increase over the previous year, when 14 oil wells and one dry wildcat were drilled contributing to a total of 46,084 feet of hole.

During mid-year 1956, a seismic survey was begun, and half of the main Island's area had been covered by the close of the year. Two structure tests at Fasht Jarim, north of the productive area, were completed early in 1956 and the shallow drilling program was discontinued thereafter.

Crude reserves were put at 159,000,000 barrels at the end of 1956. The new figure is a decrease of 11 barrels from the previous year, equalling 1956 production. However, it was noted that all oil wells on production were still flowing, assisted by the repressuring program.

Average daily crude throughput at the Bapco refinery, was 196,000 barrels per day during 1956, compared with 204,000 barrels per day during 1955. After hostilities broke out in Egypt last fall, the refinery was temporarily cut off from Saudi Arabian crude supplies, and ran at reduced output until the deficit could be made up from other Middle East sources. However, the Saudi Arabian ban on crude movements to England, France and Bahrain was lifted by mid-1957.

Construction was underway on a new 10,000 barrels per day UOP platformer, slated for 1957 completion. Foster Wheeler was the engineering and construction contractor. Refinery construction was expected to be confined to whatever was necessary to maintain efficiency of operations and quality of products.

During 1956, the Bapco refinery produced 13,314,075 barrels of gasoline; 29,854,183 barrels of fuel oil; 13,791,730 barrels of diesel oil; 4,019,017 barrels of kerosine; 3,087,346 barrels of aviation turbine fuel; 1,663,225 barrels of power kerosine; 1,419,888 barrels of topped crude; 688,572 barrels of asphalt; and 526,235 barrels of naptha.

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Turkey . . . bids for place as important crude producing nation; '56 production 2.2 million barrels.

VIGOROUS PRODUCING, refining, pipelining and exploratory activity highlighted the Turkish oil industry in 1956 and 1957. New concessions were issued, petroleum legislation relating to refinery operation by private firms was completed, part of the new products pipe line network under rapid construction was finished, and a number of companies prepared to drill exploratory wells in widely-separated parts of the country.

It was felt that Turkey would become an important crude producing nation in the future, though its potential probably is not comparable with that of the major producer countries in the Middle East. Primary areas of interest were the Thrace Basin in European Turkey (District I); the Salt Desert south of Ankara (District II); the south-central zone (District VII), bordering the Gulf of Iskenderun; District V in the far southeast, near Turkey's only current production; and District VI, also in the southeast, west of District V, along the Syrian border.

Total crude production in Turkey during 1956 was put at 2.2 million barrels, an average of nearly 6000 barrels per day, all from the government operated Raman field located in the remote southeast in the upper Tigris River valley. The entire crude yield was reported to have been charged at the Batman refinery, which went on stream on July 24, 1955, with a capacity of 7000 barrels per day.

With the completion of a 14-mile crude oil line from the Garzan field, formerly shut in, to tie it in with the government's refinery at Batman, Garzan was reported to have gone on production early in 1957. Thus, crude production this year could be expected to rise to as much as 7000 barrels daily, the approximate capacity of the refinery. Total crude production in 1955 was 1.2 million barrels (3315 barrels daily).

Concessions. Pursuant to applications for concessions dating to 1955, many of which overlapped in areas requested, 82 licenses were ratified early in 1956 and 60 additonal licenses were applied for, totaling 17 million acres, including acreage both previously granted and later requested.

See Page 349 for a review of Turkey oil laws.

The following companies had concessions in Turkey at the beginning of 1956: Standard Oil (Turkey) Inc.; Royal Dutch Shell; American Overseas Petroleum, Ltd.; Mobil Oil Turk, A.O.; Turkiye Petrolleri Anonim Ortakligu (51 percent owned by Turkish Government); Tidewater Oil Company; Deilmann Montan GmbH; Istanbul Natural Gas, Ltd.; D. D. Feldman Oil and Gas; Bolsa Chica Oil Corporation; Gilliland Oil Corporation; and Husky Oil Company.

Exploration. Exploration has proceeded rapidly. After considerable geological and geophysical work, Standard Oil (Turkey) Inc., a Jersey Standard company, spudded its first test in Thrace at Celan 1 on April 15, 1957, and abandoned it as dry at a total depth of 4350 feet on about June 1. The rig was being moved immediately thereafter about five miles west to Ozmancik on license 105. The rig is rated to about 12,000 feet.

Standard had put its first seismic crew in Thrace, a contract party (Geophysical Service, Inc.), in the field during late 1956. Another contract crew (Carter Geophysical Company) was to move into extreme southeastern Turkey (District V) in mid-1957, and a third seismic party was scheduled to enter District VI, near the border of northeastern Syria, at the end of 1957. Standard may move a second rig into the country by the end of this year.

In Thrace, where a sedimentary basin exists with most ages from Eocene to upper Tertiary being represented in the section, the following companies have conducted geological and/or geophysical work in addition to Standard's exploration there; Amoseas, Deilmann, Istanbul Natural Gas, Marmara Petroleum, Royal Dutch Shell, and Tidewater. Shell was expected to spud a well in July on block 105 in Thrace.

In Asiatic Turkey, Turkish American Oil Company, working in conjunction with Gilliland, drilled its first test starting late in 1956. The location is near the Mediterranean shore about 30 miles south of Iskenderun, where a directional hole was drilled in hopes of reaching 7000 feet where a structure was thought to have its apex some distance offshore. The well ran into technical difficulties in a Miocene salt section 300 feet thick at about 3600 feet of depth and the hole was lost.

Socony, Tidewater, and Amoseas also have conducted seismic work in Asiastic Turkey. Bolsa Chica was reported ready to make a location near Diyarbekir. Tidewater was preparing to drill near the Syrian border by mid-1957, and had contracted with Brown Drilling Company for a test located about 50 miles east of Mardin. On Nov. 18, 1956, Amoseas spudded Arel 1, its first test in southeastern Turkey on the Beyzaz structure, about 20 miles east of Gaziantep near the Syrian border with a rig capable of 12,000 feet. Brown Drilling Company is the contractor. By mid-1957, the Arel test apparently had penetrated the Cretaceous section and was drilling below 9400 feet.

By mid-1957, the Turkish Petroleum Law, which was passed in March 1954 and amended in May, 1955, had been further amended to clarify the legal status of non-Turkish crude that might be transported and refined in Turkey. This is law Number 6987, effective June 6, 1957. The amendment paves the way for construction of refineries by private groups and for use of pipe lines that would transport foreign crude through the country.

Refining. A new refinery was scheduled to be built in Turkey at a location to be decided before the end of this year by a group of international oil companies by recent agreement with the Turkish government. The companies are Mobil Overseas Oil Company, California Texas Corporation, The British Petroleum Company, and Royal Dutch Shell. Capacity of the new plant would be 65,000 barrels per day when it goes on stream, according to present schedules, in 1960.

A crude distillation unit to process Turkish and other Middle Eastern crudes, and a catalytic reforming unit

for upgrading naphtha were to be among the initial units. Automotive gasoline, kerosine, diesel and heavy fuel oil would be produced to satisfy indigenous product needs. Cost of the new plant was estimated at $48 million, of which $13.5 million will be spent in Turkey.

The four companies will form a jointly owned company to operate the new plant, with the following respective interests: Mobil, 37 percent; Caltex, 34 percent; Shell, 18 percent; and BP, 11 percent. The new plant would be expected to correct Turkey's current deficit in refining capacity. Should domestic crude production increase enough to make imports unnecessary, the new refinery will process Turkish crude only.

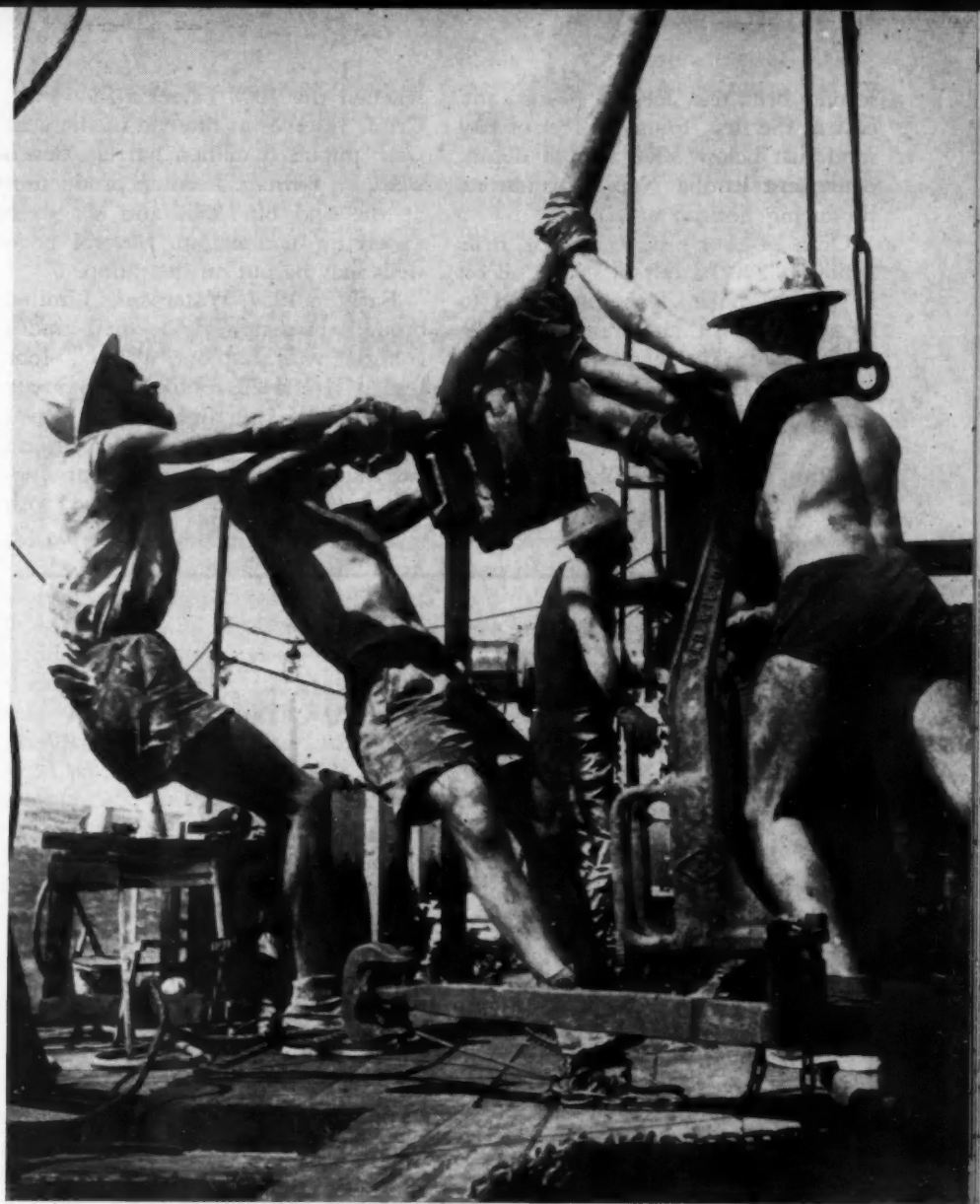
Still another refinery was proposed for Izmit, near Istanbul. William Blair, a Chicago financier, was said to have posted $10 million toward the project with the remaining $5 million to be composed of Turkish capital. However, this and other similar projects proposed for Turkey were in a pending status as of Mid-1957.

Pipe Lines. Two products pipe lines have been completed in the past two years in Western Turkey. A 250-mile, 8-inch line from the Mediterranean port of Antalya northward to Eskisehir, and a 200-mile, 4-inch line from Eskisehir to Panderma on the Sea of Marmara both have been finished.

Construction of a 450-mile, 8, 6, and 4-inch products line for the North Atlantic Treaty Organization from the Mediterranean port of Iskenderun to Batman began in 1955 and was still under way. Several contractors, including Foster Wheeler and Williams Brothers were involved in engineering and construction problems of the staged project.

Sufficient 6-inch pipe to build a line between Malatia and Erzincan in Eastern Turkey was scheduled for August, 1957, delivery.

The biggest line, of course, proposed for Turkey within the past two years would be a huge one, 38 or 40-inch line more than 1000 miles long, to carry crude from Iraq to the port of Iskenderun. The project has undergone considerable discussion, and much further preparatory work may be expected before ground might be broken. The route through Turkey has been surveyed and is feasible.



Action on drilling rig in Israel's Heletz field.

Israel . . . sets feverish pace on all fronts; new find near Heletz field.

A FEVERISH PACE of drilling, producing and pipelining operations highlighted Israel's oil industry during 1956, the first full year of oil production, and 1957. Heletz field, discovered in September, 1955, was developed thoroughly by midyear 1957. A second oil discovery was made during June, 1957, at Brur 2, located about one mile south of Heletz field, when it was beginning to appear that Heletz would be drilled up, leaving some rigs idle.

Lapidot Israel Petroleum Company, Ltd., and Israel Oil Prospectors, Ltd., the same companies that jointly found, developed and are operating Heletz field, discovered the new field at Brur. The first test, Brur 1, southwest of Heletz field, encountered shows in cores and the intervals were tested with negative results. The

See Page 335 for a review of Israel's oil laws

second Brur test, located south and east of the first, found 15 feet of pay sand just below 5000 feet of depth, equivalent to the Nubian sandstone producing horizon at Heletz.

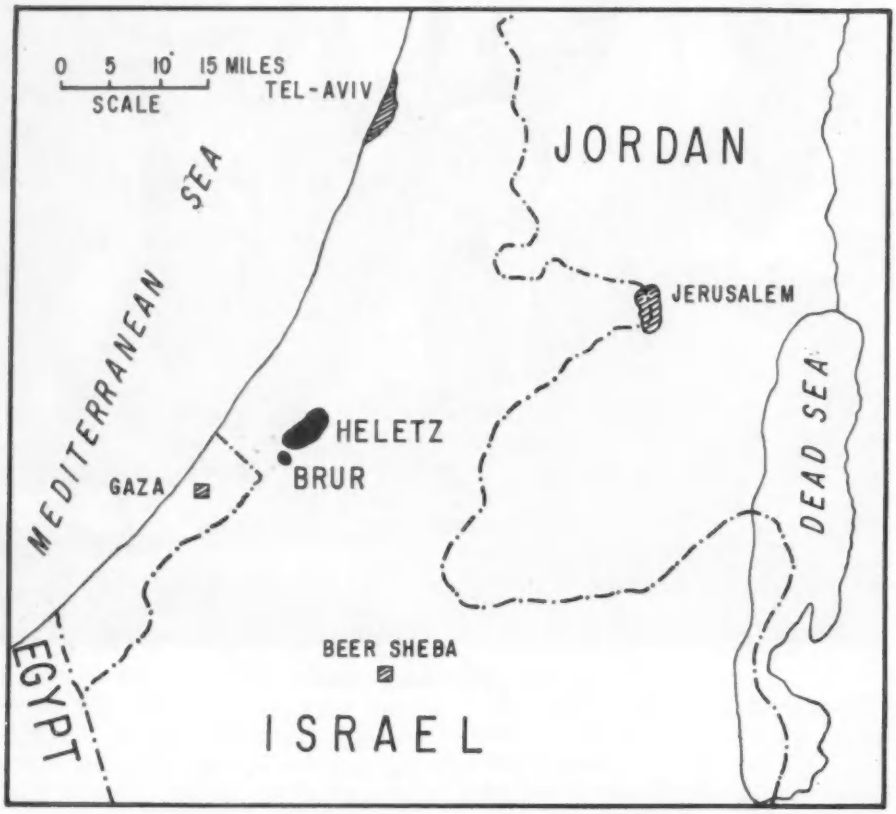
On a 24-hour production test, Brur 2 flowed 280 barrels of crude oil on a ⅛-inch choke. There appeared to be no question that the new well was separated from Heletz field to the north by a saddle and that a new discovery had been made.

Drilling. During 1956, 12 wells were completed at Heletz, and three more were drilling at year's end. Thus, 60,604 feet of hole was made in development wells completed during the year, and 6,751 feet more by the three rigs drilling at Heletz at the end of 1956. Only one well had been completed at Heletz at the close of 1955.

Cumulative production from the field reached 163,500 barrels. During 1955, a total of 12,000 barrels was produced from Heletz 1; the remainder, produced during 1956, was 151,500 barrels, or an average of 414 barrels per day.

On December 31, production had reached the 1000 barrel a day level. Crude reserves at the end of the year were put at 8 million barrels. Seven wells, all flowing, were on production at the end of 1956, and six were awaiting completion. Several edge wells may be put on the pump.

Early in 1957, Waterworks Limited brought in a new rig to drill, under contract with Lapidot, a 10,000-foot test at Heletz 22, at the approximate apex of the structure. It was hoped that deeper pays exist at Heletz, and for that reason many of the producing wells have been equipped with 7-inch casing to enable possible later deepening below the Nubian sands now producing at 5000 feet. At the same time, four tests were being drilled, two others were awaiting completion, and two, including the projected deep test, were rigging up.



At midyear, 1957, when Israel's Heletz oil field was being developed thoroughly by accelerated drilling programs, a second discovery was made at Brur 2 well, located about one mile south of Heletz. Brur 1, north and west of the discovery well was a failure, but the second test found flowed 280 barrels on a 24-hour production test.

Exploration. Other exploration was pressed, both outside of the Heletz area as well as within it. There were 103 core tests drilled during 1956 in Israel with a total footage of 138,522 feet, for an average depth of 1345 feet. Eleven wildcats were completed with an aggregate footage of 62,442 feet during 1956, with two more being drilled at the end of the year.

Considerable attention was being directed to the trend of gravity anomalies passing through Brur and Heletz, but interest was being generated in other parts of Israel, too. Israel Continental Oil Company, Ltd., completed an important test at Caesarea 1, located near the Mediterranean coast about 20 miles south of Haifa, during 1956. Interesting shows were logged in Jurassic limestones.

Early in 1957, Lapidot was drilling Sdom 1, which was expected to test a large structure below more than 8000 feet of stratified salt in the Dead Sea rift valley. Oil seeps have been found in the area, possibly associated with the fault system that created the Dead Sea Graben.

A test was spudded in March, 1957, at Sinaf 1 only about 25 miles north of exposed pre-Cambrian granites in southern Negev. Another interesting wildcat, Jordan 1, was being drilled by Israel-Continental with a portable rig early this year.

Altogether, 135,557 feet of full-hole drilling was completed in Israel during 1956. Including structure holes, the total was 274,079 feet.

Geophysical investigations carried out by the Weizmann Institute consisted of 12 party months of seismic work and 12 of gravity work, reflecting a slight decrease from 1955. Only three party months of field geological mapping was conducted last year, mainly because the companies which held prior exploration permits had completed such work. However, with the entry of two new companies, Naptha Israel Petroleum Corporation and Yehuda Israel Petroleum Company and allocation of new licenses, it was believed that geological field activity would increase during 1957.

As of April 1957, there were 32 licenses in force, covering 2.53 million acres, representing about half of Israel's total area.

Pipe Lines. A 150-mile, 8-inch pipe line intended to carry crude from the port of Elath on the Gulf of Aqaba to Beersheba, was completed in April, 1957. The new line has a daily capacity of 17,000 barrels. Plans also were under way for a 32-inch line to be laid from Elath to the Haifa refinery.

Additional storage and docking facilities were being built at Elath.

These projects were predicated on the hope that the threatened Arab states' blockade of Israeli use of the Gulf of Aqaba would not be effected and that Israel would continue to receive some oil from Iran as apparently it has in the past. An additional linking 40-mile, 12-inch line was expected to be built from Beersheba to the Mediterranean coast.

Refining. The Consolidated refinery at Haifa continued to run at about one-fourth of its capacity. An average of 22,000 barrels of crude per day was charged during 1956. During the summer of 1956, new equipment was installed to increase the gas supply to the nearby chemical plant, where nitrogenous fertilizers are manufactured. A 60-mile products pipe line from Haifa to Tel Aviv was being planned before hostilities broke out on October 29. Reportedly, work commenced in March, 1957, on this line, a 6-inch project intended to carry 6000 barrels of gasoline daily.

New Industry. Another interesting event was the development of a tubular goods industry in Israel. Much of the casing, line pipe, fittings etc., in use at Heletz field were reported to be of domestic manufacture. Eight-inch pipe for the Elath-Beersheba line was produced in 36-foot joints at a factory at Ramle. Three production lines were steadily engaged early in 1957 in manufacturing pipe ranging from 3-inch diameter up to 16-inch.

Improvements planned for the Ramle plant were expected to enable it to produce tubular goods complying with API standards in the future. This enterprise has been of assistance to Israel's oil industry, where the need for pipe, tubing, fittings, liners and other equipment has caused long shutdowns and delays in the case of several wells drilled in the past.

New Legislation. Israel's legal climate, already excellent insofar as private investment in oil exploration is concerned, improved further in 1956 and 1957. Deduction of percentage depletion of 27½ percent of gross income from oil and gas production, as long as this amount does not exceed half the net income for a taxable year, was instituted in 1956.

On Jan. 17, 1957, oil companies and drilling contractors were exempted from payment of sales and excise taxes on such locally-produced materials as tires and cement bought for oil exploration and development. Drilling contractors also were granted exemption from customs duties, a privilege formerly restricted to companies holding oil licenses. The new exemptions were made retroactive to April 1, 1954, with such taxes paid from that date through Jan. 17, 1957 to be refunded. In essence, the new legislation exempts all materials used for developing Israel's oil resources from government levy of any kind.

Other Middle East . . . First commercial oil found in Dhofar and Syria.

In other Middle Eastern areas, developments during 1956 and 1957 were highlighted by commercial oil discoveries in Dhofar and Syria.

Dhofar-Cities Service Petroleum Corporation's new Dhofar producer is located about 35 miles from the Arabian Sea coast, about 90 miles north-northeast of Murbat, and is more than 600 miles from the nearest producing area—Arabian American Oil Company's Ghawar field in Saudi Arabia.

Located on a structure 11 miles long and five miles wide, the new well, Marmul 2, produced during initial testing at a rate of 2000 barrels a day of 22-gravity crude from 3200 feet. Drilling was being continued to test lower formations.

The first well drilled on this structure, Marmul 1, about two miles northwest of Well 2, had substantial oil shows, and later production tests indicated that it also would produce at approximately the same rate as Marmul 2.

Thus, connected with a pipe line to a terminal which could be built on the coast, Marmul crude would be only about 700 miles east of the Aden refinery.

Dhofar-Cities Service is a wholly-owned subsidiary of Cities Service Company.

The Marmul structure lies 90 miles southeast of the first test drilled at Wadi Dauki in 1955. After Cities Service abandoned, for the time, the first Marmul well after at 8597 feet, the rig moved about 25 miles northward to another structure at Mazraq. There a third test was drilled to 9820 feet and abandoned in June 1957.

Mazraq 2, located two miles west of Mazraq 1, spudded shortly thereafter.

Dhofar-Cities Service continued actively exploring its 32,000-square-mile concession, encouraged by interesting structures located by surface geology and seismic operations.

During 1956 Dhofar-Cities Service completed nine party months each of seismic and core drill work, six crew-months of gravity-magnetometer work, and 12 party-months of surface geological work.

Oman. Petroleum Development (Oman) Limited, an Iraq Petroleum Company subsidiary, had completed a dry hole by midyear 1957 at an extremely remote location in the far southeastern part of the Arabian peninsula at Jebel Fahud. The test was spudded on Jan. 18, 1956 at Longitude 56° 30′ East, Latitude 22° North, and was drilled to 10,550 feet by the end of the year. By June, 1957, the Fahud well had been abandoned at a total depth of 12,235 feet.

Aden Protectorate. BP Exploration Company, Ltd., continued to view the Kamaran Islands off the west coast of Yemen in the Red Sea as part of the Aden Protectorate, and completed geological, gravity, and magnetic surveys during 1956. The small islands also are claimed by Yemen and BP's exploration rights are being disputed.

At the Aden refinery, BP refinery (Aden), Ltd., charged a daily average of 94,343 barrels during 1956. The plant has a capacity of about 100,000 barrels daily. In 1955, an average of 87,000 barrels was charged daily.

Additions to the Aden refinery, commissioned in July, 1954, continued. An LPG plant was completed early in 1956. It was planned to market LPG locally and in nearby Somaliland, Ethiopia, and the Sudan.

Standard-Vacuum Oil Company completed a $1.1 million bunkering terminal at Aden and planned to dedicate it formally on July 3, 1957.

Chicago Bridge and Iron Company

built the new installation on six acres of reclaimed land on the north side of Aden harbor. First stocks were expected to be delivered to the new terminal in mid-June, 1957. About 475 ships per month normally bunker at Aden, using the facilities of several companies. It now is estimated that Aden will lead all other bunkering ports in 1958, surpassing New York and Curacao through providing 26.5 million barrels of bunker fuels to ships putting in at Aden.

Yemen. Yemen Deilmann Petrol, a West German group holding the concession on the Tehama (Red Sea) coastal area between Hodeida and Maidi, terminated activities in August, 1956, and forfeited the concession. Deilmann was expected to drill the first well in Yemen and brought in some equipment to a Red Sea coastal point; however, the Suez crisis developed and the ensuing general Middle East political instability were factors in the decision to withdraw.

Yemen Development Corporation, which included 50 percent ownership by Oil and Gas Property Management, Inc., of Dallas, Texas, among other exclusively U. S. participants, continued exploration on its 40,000-square-mile concession consisting roughly of the northern and northeastern two-thirds of the country.

Early in 1957, Resources Development Associates was formed to acquire stock interest in Yemen Development Corporation owned by Oil and Gas Property Management, and by Walter S. Gabler of Washington, D. C.

Yemen Development was negotiating with the Yemen government to acquire a concession on the Tehama coastal strip forfeited by Deilmann. It was considered the most promising part of the country insofar as oil possibilities are concerned. At least 6000 feet of sediments, including Jurassic, Cretaceous and Tertiary beds are expected.

The strip is apparently located in a continuation of the Red Sea graben, with a north-south fault trend envisioned with possible closures along the faults. Salt outcrops in the coastal area, as well as in the Safir Basin in the extreme northeast (inland) part of Yemen.

Yemen Development worked two geological parties last year, and one geologist remained in the field in early 1957. A more extensive survey was expected to be undertaken later this year. The Safir Basin, under further study, has been shown to be relatively small and restricted. There is about 6000 feet of sediments, with Jurassic underlain by basement (granite) and overlain by Cretaceous and Tertiary.

Arabian American Oil Company forfeited a large tract of its Saudi Arabian concession in 1949 immediately opposite this area. However, Yemen Development was not restricting its exploration to oil; interesting deposits of uranium, talc, gypsum, graphite, oil shale, mica, and other minerals were reported in the remote interior.

Some interest in Yemen on the part of the Italian government oil monopoly, Ente Nazionale Idrocarburi also was reported

Jordan. Edwin W. Pauley, independent operator of Los Angeles, spudded Jordan's first test, located about 35 miles southwest of Amman near the Dead Sea. King Hussein was said to have inaugurated drilling of this well in June, 1957. The test was scheduled to be drilled to 7000 feet.

Under the terms of the agreement, ratified by the king on Feb. 5, 1956, Pauley held a concession on Jordan's entire territory, containing about 34,750 square miles, but was obligated to relinquish two-thirds of it by Oct. 2, 1956. Following considerable geological and geophysical work in Jordan, Pauley found the Jordan Valley and Dead Sea areas the most prospective, and forfeited two-thirds of the original concession area as agreed upon. If commercial deposits of oil are found in Western Jordan, crude probably would be pipelined to Aqaba and exported therefrom.

Pauley has acquired a guarantee from the International Cooperation Administration that would provide reimbursement of up to $6 million in the event of expropriation. Jordan agreed in September, 1956, to cooperate with the U. S. foreign investment guarantee program.

Syria. Syria's first commercial oil discovery was made during 1956. J. W. MenHall, independent producer and drilling contractor of Benton, Ill., found oil in the Karatchok area of extreme northeastern Syria, within six miles of both the Turkish and Iraq borders on a 117-square mile permit, one of 28 exploration permits of equal size totaling 3276 square miles. The permits are not all contiguous. Portsmouth Steel Corporation of Cleveland, Ohio, and The Atlantic Refining Company both have financial interests in MenHall's Syrian venture.

The Karatchok well was spudded on April 30, 1956, to test a pronounced surface structure on trend with the Ain Zalah oil field in Iraq, located only about 37 miles to the southeast. By the end of October, the well had reached 6780 feet. Circulation had been lost upon penetration of the top of the Cretaceous, and it was thought that about 90 feet of effective fractured limestone pay had been penetrated in intervals between 6500 and 6780 feet.

In April, 1957, the well was still being tested but was known to be capable of producing more than 1000 barrels of oil per day. MenHall was preparing a second test, located about 1½ miles from the discovery, scheduled to be drilled to 12,000 feet to test horizons below the upper Cretaceous thus far indicating for production.

The surface structure on which the well was being drilled is 15 miles long and 5 miles wide. Whether production will be extended over the entire structure was not known, but no salt water was reported in the discovery well. Initial potentials from the Cretaceous pays of the Ain Zalah field ordinarily vary from 5000 to 12,000 barrels daily.

However, the discovery had been reported to have aroused a political furor in Syria, with Communists, Socialists and extreme nationalists advocating denial of an exploitation permit to MenHall's group, after it had provided risk capital to find the oil. As of midyear 1957, the issue was in doubt.

Production. So far only slight production for local uses has been reported. The Karatchok discovery is almost as remotely located from the standpoint of markets as production in upper Iraq and Eastern Turkey. A pipe line of about 500 miles would be needed to move Karatchok oil to the Mediterranean Coast. And Syria's political situation will probably have to stabilize considerably before there are any more extensive pipe lines built through Syrian territory.

In mid-1956, about the same time MenHall's permits were acquired,

Societe des Petroles Concordia, a Damascus firm affiliated with the German company Deutsche Erdol Aktiengesellschaft of Hamburg, acquired a 5850-square-mile concession, also in northeastern Syria, and was engaged in seismic operations on its permit areas in mid-1957. It was reported that its first well would be spudded in July, 1957, in the Ghouna area of Jezira province near the Iraq border.

Early in 1957, the Syrian government accepted the bid of a Czech firm, Technoexport, to build a 20,000 barrel per-day, $16 million refinery at Homs. The location would be about 50 miles inland from the Mediterranean Coast and close to the Iraq Petroleum Company pipe line system. Bids from groups from eight nations were considered, and final consideration narrowed down to Procon, a subsidiary of Universal Oil Products and the Czechs.

Three pumping stations along the Iraq Petroleum Company pipe line system, stations T2, T3, and T4, were sabotaged by Syrian troops on the night of Nov. 2-3, 1956. This thoroughly-planned action by the Syrian government was in retaliation for the British-French-Israeli attack on Egypt, and the resumption of oil flow through Syria was refused by Syria pending the complete withdrawal from Egyptian territory of troops from the three nations.

On March 11, 1957, IPC began pumping crude through its system at a reduced rate, with Iraq stations providing the power to move the crude through the lines and quickly-constructed bypasses around the blasted Syrian stations. Throughput in 1957 was running at about 220,000 barrels per day which was expected to increase to 340,000 barrels daily by the end of the year and to the pre-November level of 534,000 barrels per day by April, 1958.

Trucial Coast, Abu Dhabi. Petroleum Development (Trucial Coast) Ltd., an Iraq Petroleum Company, subsidiary, continued exploratory drilling during 1956 and 1957. Gezira 1, located near the coast about 100 miles southeast of Dukhan field in Qatar was spudded early in 1955 and abandoned on March 9, 1956, at 12,500 feet.

Another test, Shuweihat 1, located near the coast, between Gezira and Murban, at Longitude 52° 30′ East, Latitude 24° 05′ North, was spudded on Nov. 7, 1956, and had reached 4287 feet by the end of the year. Supplies and equipment were being landed at Baraka beach, 12 miles from the wellsite. In April, 1957, the test was drilling ahead below 8800 feet.

Intensive offshore gravity, geological, core drilling and seismic operations carried on during the past several years in the Persian Gulf by British Petroleum Company, Ltd., and Compagnie Francaise des Petroles may show tangible results in the future. Abu Dhabi Marine Areas, a company whose ownership is comprised two-thirds by BP and one-third by CFP, was preparing to drill a deep test 60 miles offshore from the Trucial Coast and 20 miles east of a base of operations now being prepared on Das Island.

A drilling platform will be used for drilling in 60 feet of water. The rig is capable of drilling to 15,000 feet. It was expected that the first test would be spudded early in 1958. The "Adma Enterprise," the drilling barge being built for this test, was under construction near Kiel, West Germany, and was launched April 11, 1957, at Schacht-Audorf. On Das Island, a breakwater was being built and workshops, stores and accommodations for personnel were being constructed.

Burma . . . takes another step in postwar recovery; production totals 1,680,300 barrels in 1956.

BURMA'S OIL INDUSTRY continued to inch forward in 1956 toward recovery from almost total demolition during World War II. Crude production, including an estimated 285,000 barrels produced by local operators at Yenangyaung field, amounted to 1,680,300 barrels for an average of 4591 barrels per day.

Burma Oil Company (1954) Ltd., composed two-thirds of British interests and one-third by Burmese government participation, produced 1,395,304 barrels, for an average of 3812 barrels daily. About nine-tenths of Burma's production comes from Yenangyaung, Chauk and Lanywa fields, located about 120 miles southwest of Mandalay in the upper Irrawaddy River Valley. Yenangyat, Minbu and Yenanma oil fields and Pyaye Gas field also are located in the same general north-south trend and in the same general area along the Irrawaddy, while Indaw oil field is located 175 miles north of Yenangyat, east of the Chindwin branch of the Irrawaddy.

Activity was heightening in Burma's industry. During 1956 Burma Oil Company (1954), Ltd., drilled 15 development wells and reconditioned a number of old wells in Chauk and Lanywa fields. In addition, it undertook nine party-months of reflection seismic work in the alluvial belt of the Irrawaddy delta.

The Chauk topping plant continued to operate near its capacity of 3000 barrels daily throughout 1956. A pipe line connects the Chauk field with the Syriam refinery near Rangoon, located about 300 miles down the Irrawaddy Valley from the central Burma oil fields.

Early in 1956, preparation for drilling a deep test at Ondwe, in the Magwe district of central Burma about 30 miles south of Yenangyaung field, east of the Irrawaddy, were under way. Burma Oil Company was to drill a shallow test for natural gas first. Six wells drilled between 1912 and 1927 at Ondwe indicated a natural gas deposit which, according to current plans, was to be tapped for use as boiler fuel in a steam rig which was then to drill a well to 10,000 feet in search of oil. The projected deep test at Ondwe was BOC's first wildcat drilled since World War II.

At the Syriam refinery, demolished by the British during World War II as part of the scorched-earth policy prior to retreat from Japanese invasion, a new 3500 barrels per day crude distillation unit was dedicated in early 1957. Foster Wheeler, Ltd., built the unit under contract with BOC. Crude is being barged down the Irrawaddy River from central Burma to supply the new unit. Together with the Chauk plant, the new Syriam unit is expected to satisfy Burma's domestic demands for petroleum products.

However, the Syriam refinery is still much smaller than the 21,000 barrels per day plant that was in operation before World War II.

Part of the Digboi oil town in northeastern India. Assam Oil Company workshops and oil field stores can be seen in the foreground; in the background, derricks of producing wells.

India . . . Upper Brahmapurta Valley area pays off for Assam in crude production rise.

BADLY-NEEDED NEW crude supplies began to show in the production column in India during 1956. During the year, the nation imported 27 million barrels of crude and 13.7 million barrels of petroleum products. And the import demand outlook for 1957 indicated that 30.7 million barrels of crude and 15.35 million barrels of products would be brought into the country.

Hence, a boost in production by Assam Oil Company from 2,526,000 barrels (6921 barrels per day) in 1955 to 2,875,685 barrels (7857 barrels daily) in 1956 was welcome news to India. All production was from the upper Brahmaputra Valley area of Assam.

The old Digboi field, discovered in 1889, still was in production; Nahorkatiya field, a 1954 discovery, now being proven as a major reserve; and Moran, a 1956 discovery 25 miles west-southwest of Nahorkatiya, went into production to help boost the nation's crude yield.

Drilling. Assam Oil Company completed 12 wells in the Nahorkatiya vicinity during 1956. Nine of these were potential oil producers, one was a gas well, one was abandoned as a dry hole, and another was suspended. Wells at Nahorkatiya now are being completed in about 35 days. Production of the 35-gravity crude is from Oligocene sandstone at 10,000 feet. Some production from Nahorkatiya was moved by pipe line to the Digboi refinery.

Assam Oil completed Moran 1 at 13,739 feet, the deepest well on the Indian sub-continent. Oil production was found at 11,000 feet. An extension well was being drilled at the end of 1956.

Development drilling continued throughout 1956 in Digboi field. At Nahorkatiya, 16 wells were capable of oil production at the end of the year, with two more drilling. Estimates of the productivity of Nahorkatiya and Moran indicate that these fields could yield 18 million barrels per year. On that basis, reserves have been estimated at over 300 million barrels.

Assam Oil Company conducted seven party-months of reflection seismic work in the Upper Assam area during 1956.

Negotiations continued during 1956 between the government and Assam Oil Company to form a new company to develop the Moran, Hugrijan and Nahorkatiya concessions. Alternative sites for a new 50,000 barrels per day refinery to process the expanded crude output from these fields also were under study.

In mid-1957 it was reported that accord between Assam and the government had been reached; that an 850-mile crude oil pipe line would be built to a new refinery, very likely with Calcutta as the site to be chosen. Reportedly the new firm is to to known as Oil India, with Assam Oil holding a majority interest in exploration ventures. The Indian government would hold a minority interest. However, the government may own the majority interest in the proposed refinery.

Standard-Vacuum. Standard-Vacuum Oil Company, rapidly pursuing exploration in the Bengal Basin pursuant to a 10,000 square miles concession negotiated in December, 1953, reached the drilling stage by April 1957. An aerial magnetometer survey, conducted in 1951 by Stanvac on a reconnaissance basis, was followed up by gravity and seismic survey after the concession was granted. Gravity survey studies were completed and one seismic party remained in the field in mid-1957.

Stanvac spudded Burdwan 1, its first test in India and its third on the Indian subcontinent, on April 18. The location is 30 miles northwest of Calcutta. The contractor is Southeastern

THROUGHOUT THE OIL WORLD

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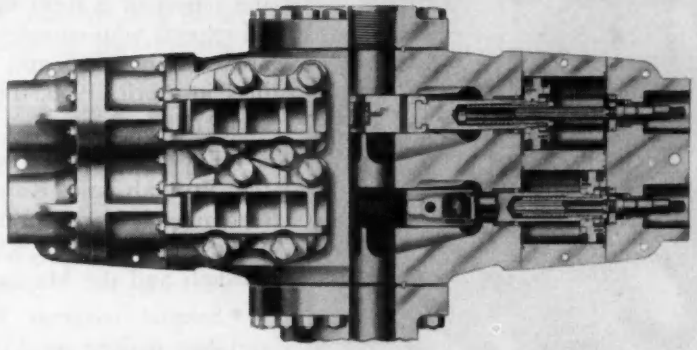

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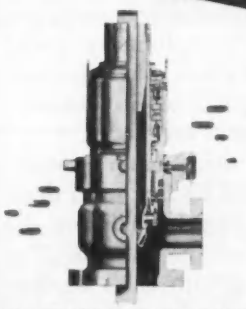

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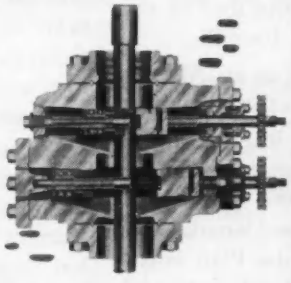

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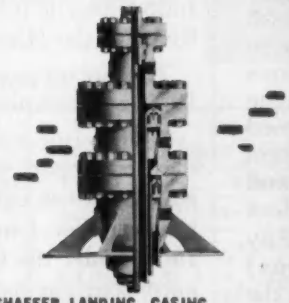

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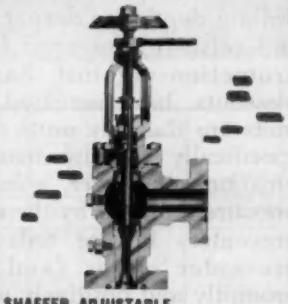

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Asia Drilling Company, a subsidiary of Southeastern Drilling Company of Dallas, and the test was projected for 10,000 feet.

Russian Report. The Indian Government, taking a progressively more active hand in oil matters, received the report of a team of three Soviet oil experts who surveyed the nation's areas during 1955 and filed its findings in April, 1956. The group recommended:

- Exploration be concentrated in the Punjab and Rajasthan. Other recommended areas were the Ganges Valley, West Bengal, Cambay, Uttar Pardesh and the Madras Coast.
- Seismic coverage for 16 areas, and core drilling for 13 others.
- Gravity and magnetic surveys of 176,000 square miles and geologic mapping of 11,400 square miles.
- Deep drilling in six areas in the Punjab, in Jaisalmer, the Ganges Valley and West Bengal.
- Organization of 14 gravity, 10 seismic, 14 geological, 5 core drill parties, and 5 deep drilling teams.

Also of interest were the findings of an airborne-magnetometer survey of 17,000 square miles in Rajasthan in northwest India adjacent to Pakistan, and 90,000 square miles in the Indo-Gangetic plains from the Ganges River to the Himalaya foothills.

The survey was begun in March, 1956, and completed in three months.

Following careful interpretation, the final report was presented to the government in early 1957. The survey was paid for jointly by Canada and India under the Colombo Plan assistance program for underdeveloped countries, and was the first natural resources survey so financed to be completed to the report stage.

Spartan-Canadian Aero, of Ottawa, Canada, affiliate of Aero Service Corporation of Philadelphia, Penn., conducted the survey and data interpretation. The results were described as extremely encouraging. The survey was intended as a guide for more detailed geophysical work preparatory to possible drilling. The data were interpreted to indicate that oil-bearing strata productive on the Potwar Plateau in Pakistan may extend into Rajasthan. Later, it was indicated that the Lucknow-Benares-Patna region, where bedrock is deeply buried by a thick mantle of alluvium deposited by the Ganges River during many centuries, may have interesting geological structures.

Government Active. The Indian Government, with the formation of the Oil and Natural Gas Commission to deal with various aspects of the oil industry including exploration, development and refining, was becoming more active in oil matters.

A comprehensive program of geophysical investigation in Jaisalmer had been drawn up by late 1956 and both geophysical and geological parties were being sent to the field. India's second Five Year Plan contains specific, ambitious provisions for oil exploration, entailing an $18 million outlay for oil. It includes formation of a joint enterprise in Assam with Assam Oil Company for exploration, development and transport of crude oil.

In the Punjab, the commission seeks to determine the thickness of the sedimentary section and to undertake deep drilling as appropriate. Similar investigations complete to the stratigraphic drilling stage were planned for Rajasthan. Aeromagnetic work and other geophysical work leading up to drilling were planned for the Ganges Basin. In West Bengal, the government has 25 percent participation in Stanvac's exploratory work. Geological, geophysical, and structure-drill work were projected in Cambay-Cuth and east costal regions.

By mid-1956 the Indian government had spudded its first deep drilling venture at Jawalamukhi in the Kangra Valley of the Punjab. The test, being drilled with a 45-ton Rumanian rig, manned by a Rumanian crew, was projected to 11,000 feet. East Indians were said to be undergoing training by the Rumanian crews. Two years of the services of a Soviet engineer also was included in the deal. The Jawalamukhi location was one of nine locations in the Kangra Valley said to be staked by the government.

The Rumanian rig apparently was the first of several ordered from Iron Curtain countries. The Indian government announced in late 1956 that three Russian rigs would be put to work in Punjab. They were to arrive one each in April, September and November, 1957. Russian crews were to man these rigs.

Japan . . . Need for domestic oil spurs exploration activities; production off 181 bpd.

EXPLORATION OPERATIONS keynoted the Japanese oil industry developments in 1956 and 1957 as it became increasingly difficult to maintain the 6000-barrel-a-day crude production level at which the nation's yield has been hovering since 1952. Indication of Japan's dire need for the discovery of new domestic oil supplies was its supply-demand balance.

Domestic consumption last year amounted to 224,563 barrels per day, totaling 82,190,000 barrels for the year. And imports, primarily crude oil, rose to a level of 259,533 barrels a day, or 94,989,000 barrels during the year.

Exploration. Japan Petroleum Exploration Company (JAPEX) conducted an extended exploration program in 1956, continuing it into 1957. Its seismic activity included 76 party months, 19 party months more than conducted during the previous year.

The program included marine seismic operations by Geophysical Services, Inc., a U. S. firm, which were conducted in the Japan Sea off Akita Prefecture. Favorable structures reportedly were found by this study and a detailed survey was scheduled in 1957.

PRAKLA, a German seismic crew, was conducting operations in Niigata Prefecture, covering areas in Hokkaido, Akita, Yamagata and Niigata, where indications of oil have existed, and in the Kanto Plain, where the outlook was considered bright.

A total of 25 party months of gravity surveys was conducted over the same areas subjected to seismic study. A marine survey was under-

Photo courtesy The National Supply Co.

NO CHERRY BLOSSOMS HERE—Japan's first rig for deep drilling is shown (right) as it looked at the time of its "spudding in" ceremony. Although the date marked the "first day of Spring," according to the old Japanese calendar, the weather was bitter cold and there was as much as six feet of snow.

Drilling and Production in Japan

COMPANY	Crude Production During 1956 by Company (Barrels)	Natural Gas Production During 1956 by Company (in Cubic Feet)	No. of Crude Producing Wells at End of 1956 by Company	No. of Natural Gas Producing Wells at End of 1956 by Company	No. of Wells Shut in as of December 31, 1956	Amount of Footage Drilled During 1956 (In Feet)	Number of Field Wells Completed During 1956 and Results				No. of Wildcat Wells Drilled During 1956 and Results			No. of Wells Drilling at Dec. 31, 1956
							Oil	Gas	Dry	Total	Oil	Gas	Dry	
Teikoku Oil Co.														
Hokkaido	14,275	23,820,546	110	1	10	11,309	0	0	1	1	0	0	0	1
Akita	1,596,486	519,360,357	1,289	0	457	278,188	47	0	12	59	0	0	1	10
Yamagata	199,190	47,805,096	48	0	13	3,749	0	0	1	1	0	0	0	0
Niigata	275,824	1,937,369,582	1,042	76	366	95,569	5	27	1	33	0	0	1	11
Daido Oil Co.														
Akita	2,565	0	7	0	1	4,614	0	0	0	0	0	0	0	0
Niigata	2,352	0	13	0	1	0	0	0	0	0	0	0	0	0
Nippon Pet. Mining Co.														
Akita	7,353	0	16	0	4	0	0	0	0	0	0	0	0	0
Nihon Kogyo														
Akita	2,025	0	4	0	2	4,088	0	0	1	1	0	0	0	0
Nihon Gas Co.														
Niigata	0	385,736,938	0	14	0	14,841	0	2	0	2	0	0	0	0
Oil Shigen Kaihatsu														
Hokkaido	346	0	n.a.	0	4	59,895	1	0	0	1	2	0	13	6
Niigata Kotsu Co.														
Niigata	0	201,738,053	0	16	0	5,659	0	3	0	3	0	0	0	0
Nihon Sakusen Co.														
Niigata	0	800,598,281	0	34	2	0	0	2	0	2	0	0	0	0
Hokuriku Gas Co.														
Niigata	0	289,597,811	0	20	0	0	0	0	0	0	0	0	0	0
Nihon Light Metal Co.														
Niigata	0	137,299,068	0	12	5	0	0	1	0	1	0	0	0	0
Kyoei Kogyo Co.														
Niigata	0	149,139,888	0	9	0	0	0	0	0	0	0	0	0	0
Nitto Boseki Co.														
Niigata	0	180,605,637	0	10	5	0	0	0	0	0	0	0	0	0
Otaki Natural Gas Co.														
Chiba	0	376,598,403	0	32	35	143,734	0	4	0	4	0	0	0	30
Nihon Natural Gas Co.														
Chiba	0	257,538,386	0	31	4	0	0	0	0	0	0	0	0	0
Keto Natural Gas Co.														
Tokyo	0	76,049,367	0	7	6	9,967	0	1	0	1	0	0	0	2
Others	68,552	857,675,946	910	284	571	48,836	0	0	0	0	0	0	0	7
Total	2,168,968	6,240,933,359	3,439	546	1,486	680,449	53	40	16	109	2	0	15	67

taken in the southern part of Akita Prefecture for the first time.

Most of the geological activity was aimed at Hokkaido and the Kanto Plain, where a total of 133 party months was recorded during the past year.

Drilling. A total of 109 field development wells was drilled last year, in addition to 17 exploratory tests, as compared with 203 field completions and 15 wildcats reported for 1955. However, 1956's footage drilled figure of 680,449 feet amounted to 133,352 feet more than drilled during the previous year.

Of the 109 field wells completed last year, 53 found oil, 40 were gas producers and 16 were dry holes. This compares with 1955 results of 75 oil wells, 95 gas producers and 33 failures.

Last year's 17 wildcat tests resulted in two oil wells. The remainder were dry holes. During the previous year, wildcat drilling produced only one oil well.

At year's end 67 wells were drilling, 16 more than were in operation at the same time of the previous year.

Fifteen wildcat tests were completed by JAPEX during the year, and the exploration company reported five more drilling at the close of the year. One of the test wells was at Biratori, south of the Hokkaido Tertiary basin, and it found some production at 1500 feet. A second well also found production.

At Tamugiyama, in southern Niigata Prefecture, JAPEX found an oil sand in an exploratory test drilled to 4944 feet, however, owing to heavy snow, had halted the operation.

Teikoku Oil Company was drilling a deep test at Ohguchi gas field in Niigata Prefecture in 1957, and had found a good oil and gas showing between 4528 feet and 5085 feet. The sand had not been tested.

Oil Production. With daily average crude oil production of 5926 barrels, Japan's total output for the year reached 2,168,968 barrels. This represented a decrease of 181 barrels per day from the previous year.

Last year's oil production came from 3439 wells. At year's end, 1486 wells were shut in. Thus, the number of producing wells decreased 73 from 1955, when 3512 wells were in production.

However, natural gas production reflected a rise of almost 764 MMcf

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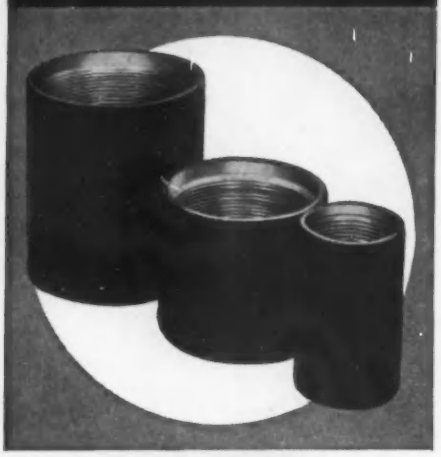

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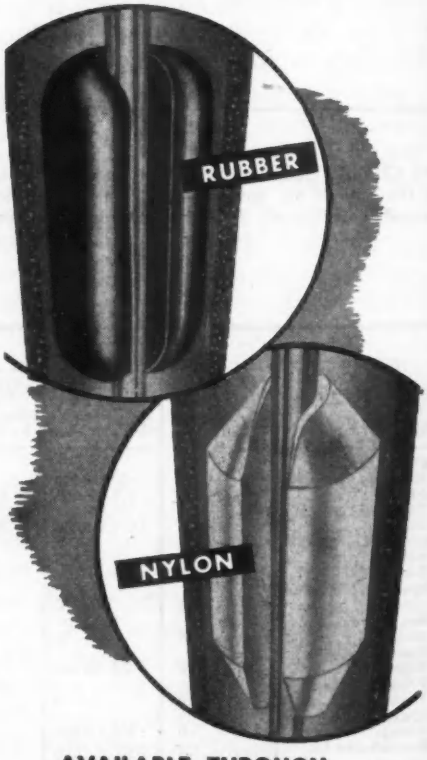

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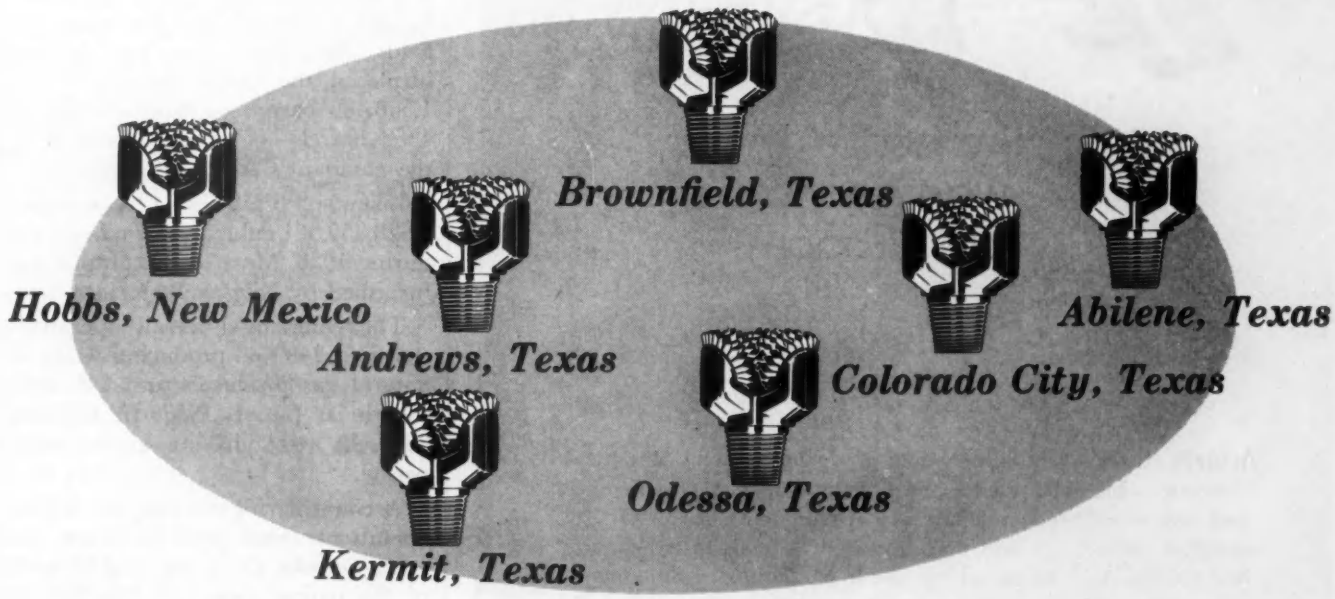

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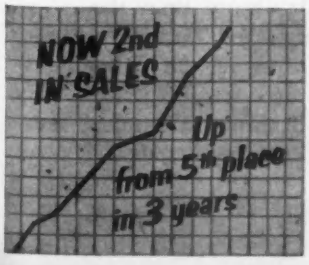

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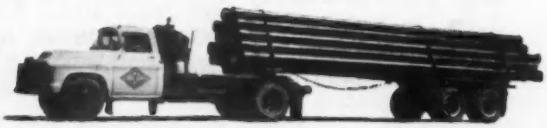

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during the year. Production in 1956 was 6,240,933,359 cubic feet as compared to 1955's natural gas output of 5,476,993,000 cubic feet. This increase was accounted for by the increased number of gas producers reported in production last year. Five hundred and forty-six producers in 1956 amounted to an increase of 74 from 1955, when 472 gas wells were in production.

Again, in 1956, Teikoku Oil Company accounted for most of Japan's domestic crude production as well as the largest slice of its natural gas output. The company's oil output of 2,085,775 barrels was tantamount to daily average production of almost 5700 barrels.

Teikoku Oil's major producing area is Akita Prefecture, location of Yabase, Kotaki, Hanekawa and Hachimori oil fields. And again last year Yabase furnished the major portion of the 1,596,486 barrels—a daily average of 4362 barrels—of crude produced by the company's Akita installations.

Likewise, Teikoku Oil supplied 2,528,355,581 cubic feet of natural gas during 1956. Most of this output was furnished by Niigata Prefecture.

The company's overall operations recorded 2489 oil-producing wells, 77 natural gas producers and 846 wells shut in at Jan. 1, 1957. In addition, 22 wells were drilling at the same period.

Accounting for most of the drilling operations conducted in Japan last year, Teikoku Oil completed 96 wells of the nation's total of 126. Ninety-four of these completions were field development wells, of which 52 found oil, 27 became gas producers and only one was a dry hole. Two wildcat efforts during the year both resulted in failures. The company drilled a total of 388,815 feet of hole.

In this category, too, Akita Prefecture was the leader with 60 completions, of which 47 produced oil and 12 found natural gas. Drilling footage last year in the prefecture totaled 278,188 feet.

Refining. Japan's refining capacity increased to a daily average of 333,200 barrels by the end of 1956, 74,100 barrels per day more than the daily throughput reported during the previous year. Most of the increased capacity resulted from expansion by Nippon Oil Refining Company and Showa Oil Company.

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Indonesia and British Borneo

. . . Production climb continues in both countries.

PRODUCTION IN Indonesia increased during 1956, due to stepped-up yield from Sumatra's Minas field, operated by Caltex Pacific Petroleum Company. Crude production in the newly-developed major Mina field increased from 61,300 barrels per day in 1955 to more than 80,000 barrels daily by mid-year 1956.

By early 1957, Minas field had doubled its mid-1956 rate during a few days of peak production and transmission. Caltex expected its 1957 production, all from Central Sumatra fields, to exceed 110,000 barrels per day.

The two Royal Dutch Shell Companies, N V de Bataafsche Petroleum Mij and NVNIAM, were still leaders among producing groups in 1956, but depletion of old fields and lack of governmental encouragement to increase drilling and exploration caused crude yield to wane. Standard Vacuum Oil Company was temporarily in a similar position, but production was expected to increase substantially upon completion of a new pipe line scheduled for early 1958. Caltex, too, announced plans for expanded pipe line and terminal facilities in early 1957.

Total crude production in Indonesia in 1956 totaled 93,819,867 barrels, a daily average of 256,338 barrels. This represented an increase of 9.19 percent from the 1955 total of 85,920,511 barrels.

Royal Dutch Shell companies produced 38,347,410 barrels in Indonesia in 1956, for a daily average of 104,774 barrels. Compared with 1955, when 106,863 barrels daily were produced, totaling 39,004,840 barrels for the year, the 1956 total represented a drop of 1.68 percent. A further decline was indicated by average daily production in December, 1956, which was below the year's average. For details of Royal Dutch Shell production in Indonesia see accompanying table.

Drilling. Shell's drilling was increased slightly in 1956, when 62 wells were drilled aggregating 288,189 feet of hole, as compared with 57 wells and 266,863 feet drilled in 1955. Twenty-three fields were on production during the year, up two from 1955. Setiti field in South Sumatra, discovered in 1936, went on large-scale production for the first time in 1956 and produced 109,720 barrels, with the rate being increased at the end of the year. Unlike most Indonesian oil fields, Setiti produces asphalt base oil. Producing interval is from 1850 feet to 1970 feet in Miocene sand, and gravity of the oil is 40.1.

During the year, five of Shell's producing fields in South Sumatra were transferred from NV de BPM to NVNIAM operation. In Kalimantan (Indonesian Borneo), Shell was reported considering construction of a pipe line to carry heavy crude from Tarakan field to the Balik Papan refinery.

Some progress was reported during the year in negotiations between Shell and the Indonesian government to-

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ward settling the problem of the North Sumatra concessions which have not been returned since the end of World War II. Previously, Royal Dutch had nine oil fields on production in North Sumatra and a refinery on stream. Small quantities of oil were being produced for local use in North Sumatra on Shell's old concessions there.

Caltex Pacific. Caltex Pacific Petroleum Company produced a total of 32,441,357 barrels during 1956, an average of 88,638 per day, for an increase of 10,068,433 barrels above 1955's record of 22,372,924 barrels. That was an increase of 45 percent.

At the end of 1956, Caltex had 111 flowing wells, 21 on the pump and 56 potential producers shut in. During the year, Caltex drilled 26 oil wells and abandoned one test. Total footage drilled was 45,072 feet. One exploratory well, Pungut 4, was abandoned at a total depth of 3681 feet.

In 1955, Caltex drilled 25 field wells for a total of 67,867 feet of hole; hence its drilling program has been of about the same order except that last year's wells were not so deep, on the average, as those drilled in 1955.

In early 1957, Caltex announced plans for an important pipe line project to link Duri and Bekasap oil fields in Central Sumatra, 35 miles northwest of Minas, to a deep-water tanker terminal to be built on the northeast coast at Dumai on the Malacca Strait. A 30-mile, 30-inch pipe line will be built by International Bechtel, Inc., of San Francisco, Calif., contractors, between Duri field and the port of

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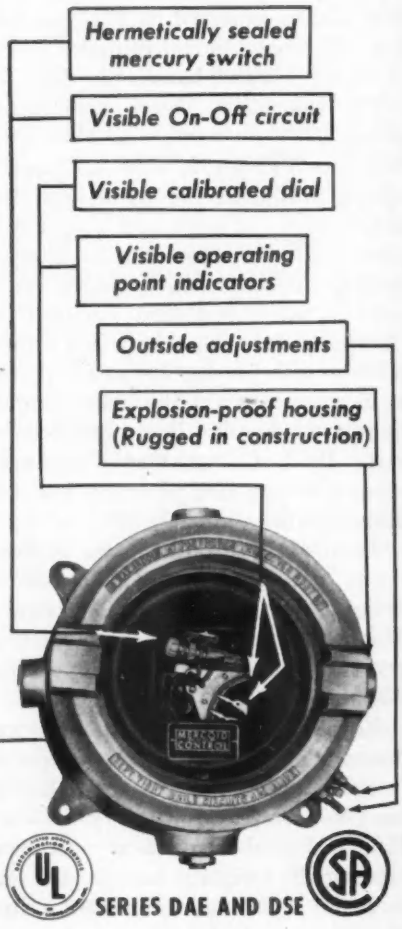

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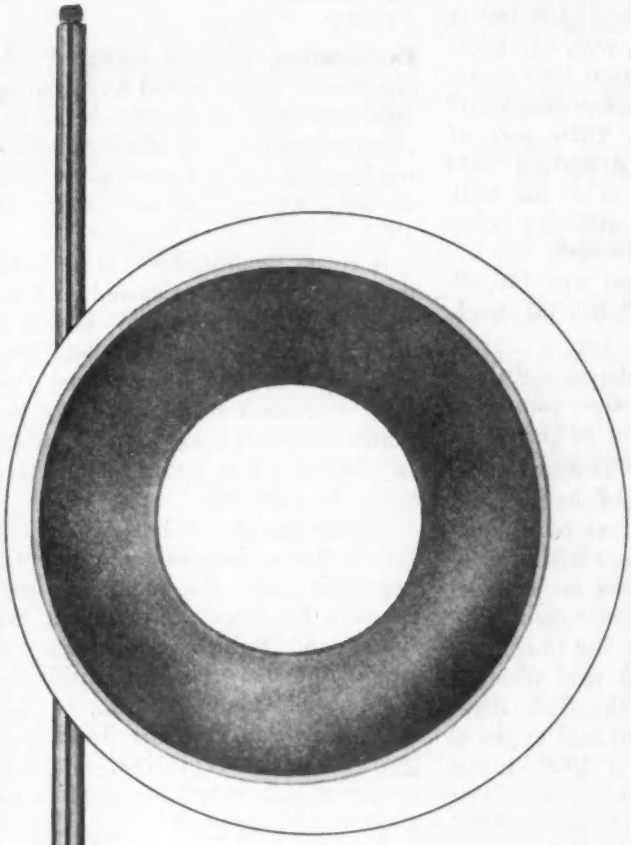

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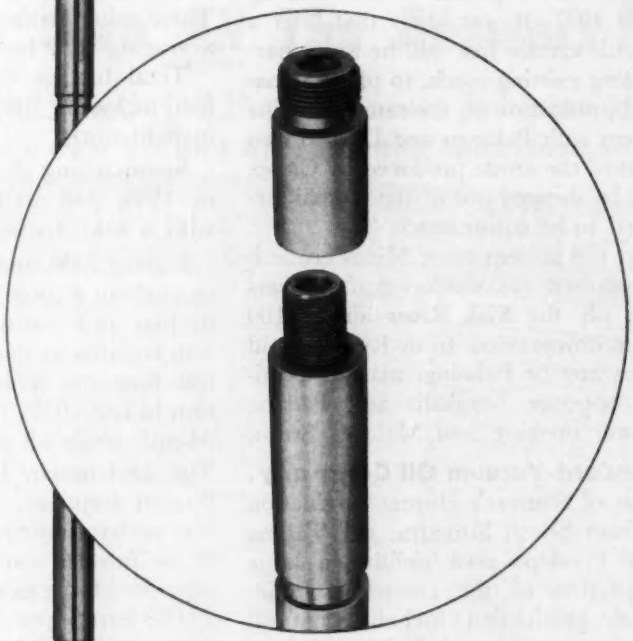

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Dumai, located opposite Rupat Island.

Completion of the new line was scheduled for late 1958 or early 1959, at which time Duri and nearby Bekasap field will be put on production.

Duri is a shallow field, with Miocene pay sands being found at about 800 feet. The crude is heavy (22 gravity) and paraffin base. Nineteen wells had been completed in the field by early 1957. It was likely that later a 35-mile crrude line will be built, paralleling existing roads, to place Minas field production on the same pipe line system with Bekasap and Duri so that most of the crude produced by Caltex will be shipped out of the Dumai terminal to be constructed.

At the present time, Minas crude is transported via shallow-draft tankers that ply the Siak River almost 100 miles downstream from Rumbai and Perawang to Pakning, marine terminal opposite Bengkalis and Padang Islands opening into Malacca Strait.

Standard-Vacuum Oil Company. Most of Stanvac's current production is from South Sumatra, the Talang Akar-Pendopo area yielding a large proportion of the company's total. Crude production, including natural gasoline, aggregated 23,031,100 barrels, for a daily average of 62,927 barrels during 1956, a decrease of 6.16 percent from the previous year. As of Dec. 31, 1956, Stanvac had 532 wells producing oil, gas and condensate, of which 281 were flowing, and 251 were on gas lift. In addition, 347 wells capable of production were shut in.

Stanvac drilled 42 development wells during 1956, including 40 oil wells and two dry holes. Another field well was drilling at the year's end. Six exploratory wells, totaling 31,405 feet of hole, were completed, with two additional wildcats drilling at year's end. Two wildcats were completed as oil producers, averaging 2628 feet of depth. Another was drilled to 7700 feet and completed as a gas well. Three other wildcats were dry holes, averaging 4852 feet of depth.

Total footage drilled was 136,996 feet, including 105,591 feet for development work.

Summarizing all Indonesian drilling in 1956, 138 wells were completed with a total footage of 473,938 feet.

During 1956 and 1957 Stanvac has carried out a program of development drilling and construction of production facilities in the Sago field of Central Sumatra, scheduled for completion in late 1957. The new eight-inch, 94-mile crude oil pipe line to connect Sago and nearby Lirik field with the Buatan terminal on the Siak River was under construction and expected to be finished early in 1958. Initial capacity of the new pipe line will be 20,000 barrels per day, to be expanded later to 32,000 barrels daily.

Lirik crude is heavily paraffinic, with a pour point of 105. The Lirik-Buatan pipe line is one of the most unusual in the world, with four stations installed at 18-mile intervals along the way to boost temperature of the crude to 153° F. so that it will reach the next heater pump station without dropping to the pour point and congealing. Hence, Stanvac is doing what is tantamount to arctic-type pipelining in Sumatra—at the equator.

Exploration. Stanvac operated only one seismic party in Indonesia during 1956 and 1957, exploration being discouraged by the political climate. Caltex kept one seismic party in the field during 1956 and added another in 1957.

A revolt against the central Indonesian government occurred in Central Sumatra in early 1957, as well as in other Indonesian localities. However, by mid-1957, it appeared that some resolution of viewpoints of Sumatra and other outer islands opposed to the central government in Java might be expected.

By the middle of 1957, it became known that an independent group was negotiating with the Indonesian government for concessions in Java, Sumatra and Borneo. Should current negotiations between New British Dominion Oil Company, Ltd., of Calgary, Canada, and the Indonesian government materialize, a fourth group would enter the exploration picture in the country.

Ball Associates, of Washington, D. C., also are involved in the proposed venture.

Refining. The modernization program at Stanvac's Palembang refinery in South Sumatra was being completed ahead of schedule. A plant designed for production of 1380 barrels per stream day of polymer gasoline commenced operating in February,

Royal Dutch Shell's Drilling and Producing Activities in Indonesia in 1956

Name of Company	Field	Location	Year Discovered	Footage Drilled in 1956	Total Wells Completed in 1956	Oil	Gas	Dry	Wells Drilling 12-31-56	Number Wells Producing 12-31-56	Total 1956 Crude Production in Barrels	Average Production 1956 Barrels Daily	Crude Production, Barrels Daily December, 1956
N. V. De BPM (Shell)	Kawengan	Java	1926	0	0	0	0	0	0	83	3,163,160	8,643	8,150
N. V. De BPM (Shell)	Kruka	Java	1929	0	0	0	0	0	0	51	223,610	611	590
N. V. De BPM (Shell)	Anggana-Muara	Kalimantan	1902	0	0	0	0	0	0	86*	637,170	1,741	1,690
N. V. De BPM (Shell)	Balik Papan	Kalimantan	1903	0	0	0	0	0	0	0	2,620	7	25
N. V. De BPM (Shell)	Sambodja	Kalimantan	1910	0	0	0	0	0	0	48	334,670	914	940
N. V. N. I. A. M.	Bunju	Kalimantan	1930	22,037	3	3	0	0	1	34	3,286,080	8,978	9,360
N. V. De BPM (Shell)	Sanga Sanga	Kalimantan	1897	0	0	0	0	0	0	88**	1,138,330	3,110	2,380
N. V. De BPM (Shell)	Tandjung	Kalimantan	1938	10,670	2	2	0	0	0	0	68,750	188	120
N. V. De BPM (Shell)	Tarakan	Kalimantan	1906	387†	0	0	0	0	0	406	1,385,220	3,785	3,420
N. V. De BPM (Shell)	Babat	South Sumatra	1901	0	0	0	0	0	0	20	14,750	40	50
N. V. N. I. A. M.	Badjubang	South Sumatra	1927	2,926	1	1	0	0	0	29	905,770	2,475	2,400
N. V. De BPM (Shell)	Genung Kemala	South Sumatra	1938	36,530	4	4	0	0	1	20	1,826,750	4,991	3,440
N. V. N. I. A. M.	Kenali Asam	South Sumatra	1931	30,354	13	12	1	0	1	101	4,568,650	12,483	10,210
N. V. De BPM (Shell)	Limau	South Sumatra	1928	127,229	23	22	0	1	3	49	6,366,280	17,394	18,710
N. V. De BPM (Shell)	Mangundjaja	South Sumatra	1935	0	0	0	0	0	0	42	617,140	1,686	1,530
N. V. N. I. A. M.	Meruo Senami	South Sumatra	1938	7,526	2	1	1	0	0	6	101,220	277	250
N. V. De BPM (Shell)	Prabumulih West	South Sumatra	1953	17,142	3	3	0	0	0	10	1,392,830	3,806	4,080
N. V. De BPM (Shell)	Sei Taham	South Sumatra	1903	0	0	0	0	0	0	0	1,080	3	0
N. V. N. I. A. M.	Setiti	South Sumatra	1936	14,550	5	3	0	2	0	3	109,720	300	940
N. V. De BPM (Shell)	Suban Djerigi	South Sumatra	1905	0	0	0	0	0	0	21	209,570	573	670
N. V. De BPM (Shell)	Talang Djimar	South Sumatra	1937	15,912	4	4	0	0	0	90	7,045,010	19,249	18,390
N. V. De BPM (Shell)	Tandjung Tiga	South Sumatra	1940	0	0	0	0	0	0	29	2,089,330	5,709	5,950
N. V. N. I. A. M.	Tempino	South Sumatra	1931	2,926	2	2	0	0	0	95	2,859,700	7,813	8,480
TOTAL	.....	.....	....	288,189	62	57	2	3	6	1,311	38,347,410	104,774	101,775

* Includes 3 gas wells. ** Includes 5 gas wells. † Deepening old well.

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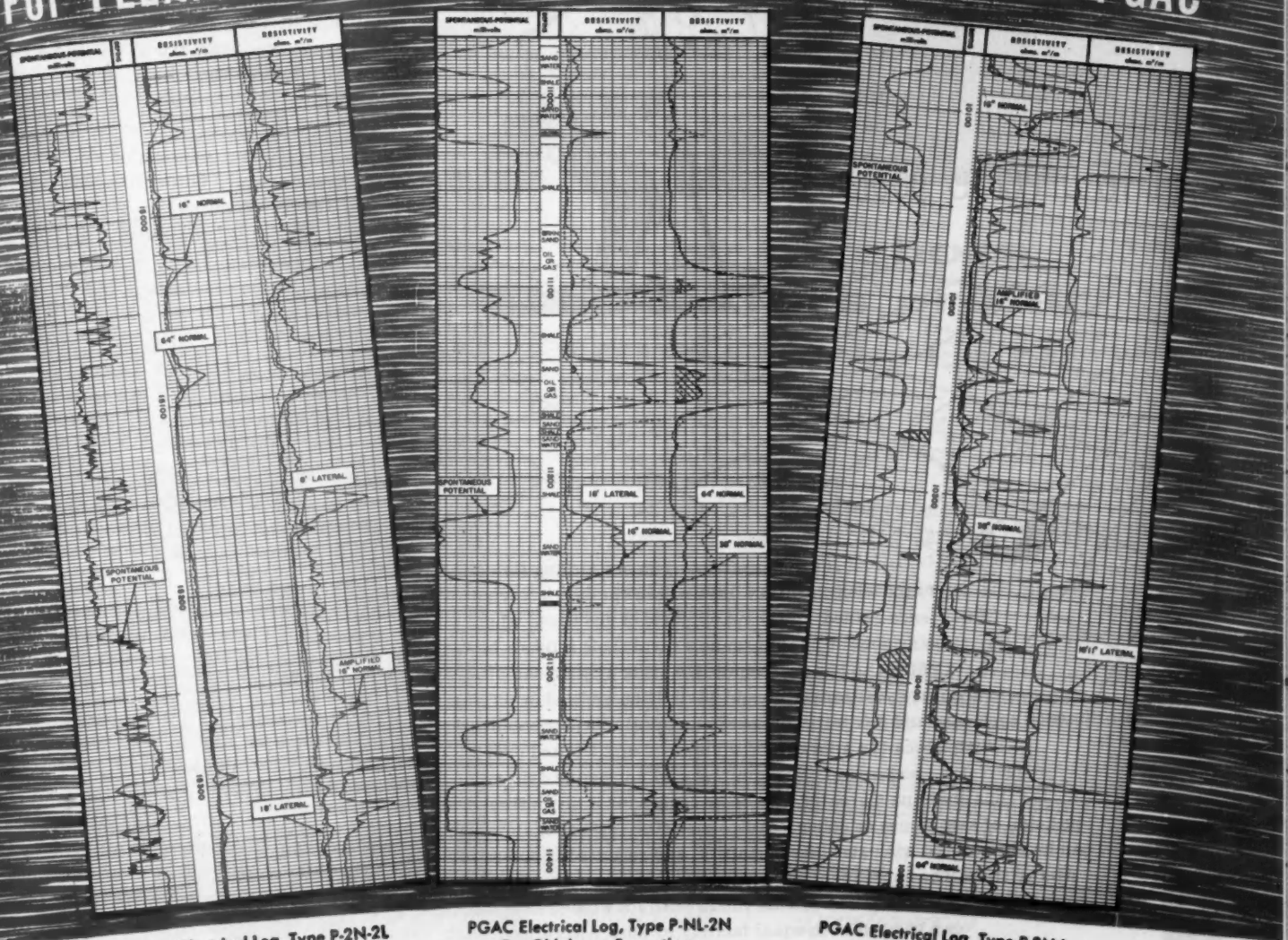

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1957. The fluid cat cracker, originally scheduled for January, 1958, completion, was expected to go on stream in August, 1957. The refinery has a charging capacity of about 65,000 barrels daily and has been running at approximate capacity for several years.

Royal Dutch Shell continued to operate its Indonesian refineries as best it could, without significant modernization or expansion being pursued. N V de Bataafsche Petroleum Mij has five refineries in Indonesia, four of which are on stream and the fifth, at Brandan in north Sumatra, shut down since the concession has not been renewed. Pladju, in Sumatra, was running at its charging capacity of 95,000 barrels daily; Balik Papan, in Borneo, with a crude distilling capacity of 59,000 barrels daily, was charging 54,500 barrels at the end of 1956. Small Shell refineries at Tjepu and Wonokromo in Java were running near capacity, charging 3500 barrels and 3000 barrels daily, respectively.

British Borneo. Oil activity in Northwest Borneo is confined to Sarawak, Brunej, North Borneo and areas offshore therefrom, since the region is politically separate from Kalimantan, the Indonesian (and far larger) portion of Borneo. All operations are carried on by members of the Royal Dutch Shell group.

Production continued to increase as British Malayan Petroleum Company, Ltd., coaxed rising yields of crude from Seria field, source of almost all crude now being produced in British Borneo. Total British Borneo production in 1956 was 42,502,808 barrels, averaging 116,127 barrels daily, an 8 percent increase from the 1955 total of 39,351,213 barrels. The Seria field produced 41,994,047 barrels, or 114,737 per average day in 1956. Sarawak Oilfields Ltd. produced 508,761 barrels, or 1390 barrels per day from Miri field. Both fields thus upped their outputs in 1956 as compared to 1955.

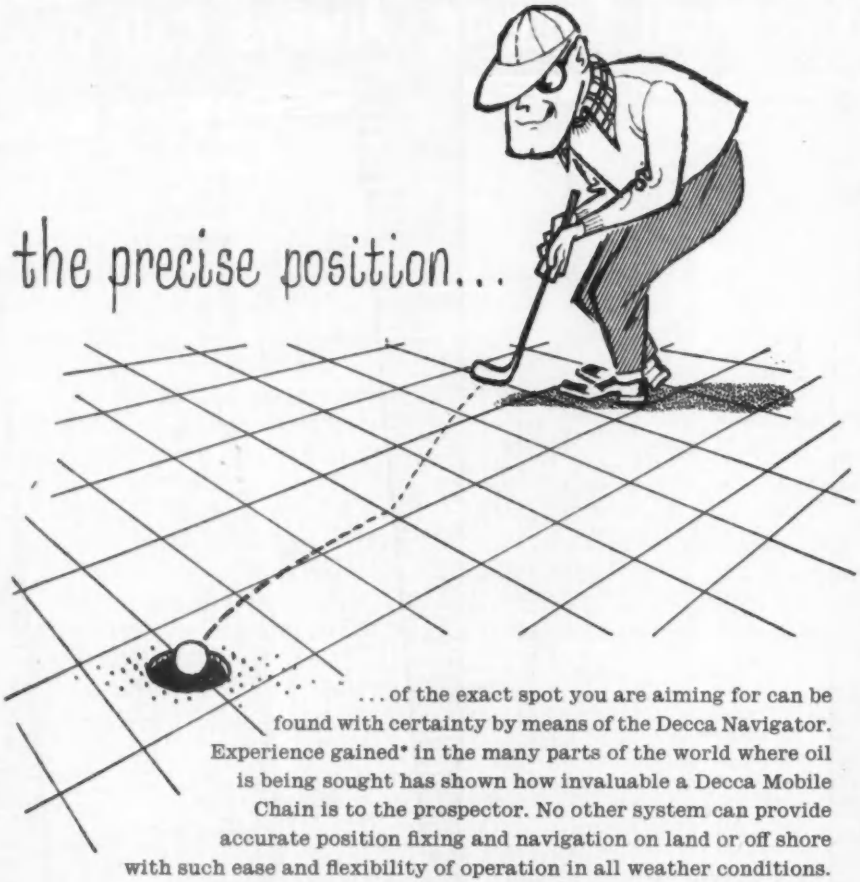
British Malayan recorded 286 wells on production at the end of 1956, including 131 flowing, 33 on pump and 122 on other means of artificial lift. There were 124 wells shut in at the year's end. Cumulative production from Seria to Dec. 31, 1956, exceeded 365 million barrels, including oil estimated to have been produced by the Japanese during World War II. The crude is of mixed base, varies between 19 and 38 gravity, and is found in a number of Tertiary sands from 1300 to 7300 feet. Average depth of development wells drilled at Seria in 1956 was 6413 feet.

British Malayan reported the drilling of 36 wells in 1956, in Seria field, all of them completed as oil producers. Total footage drilled in this operation was put at 230,863 feet. Three wells were drilling at Saria at the end of the year. There also were 38 wells abandoned, awaiting abandonment or with drilling suspended at the year's close. One workover rig was active in Seria field in 1956.

Sarawak Oilfields, Ltd., reported no drilling at Miri during 1956. There were 179 wells producing at the end of the year, all of them pumping. Also, 138 wells were shut in. An additional 297 were abandoned, awaiting abandonment or with drilling suspended. At Miri, producing depths vary from 300 to 3050 feet. The crude is of

Production in British Borneo

FIELD	1956 PRODUCTION (In Barrels) Year	Daily
Seria	41,994,047	114,737
Miri	508,761	1,390
TOTAL	42,502,808	116,127



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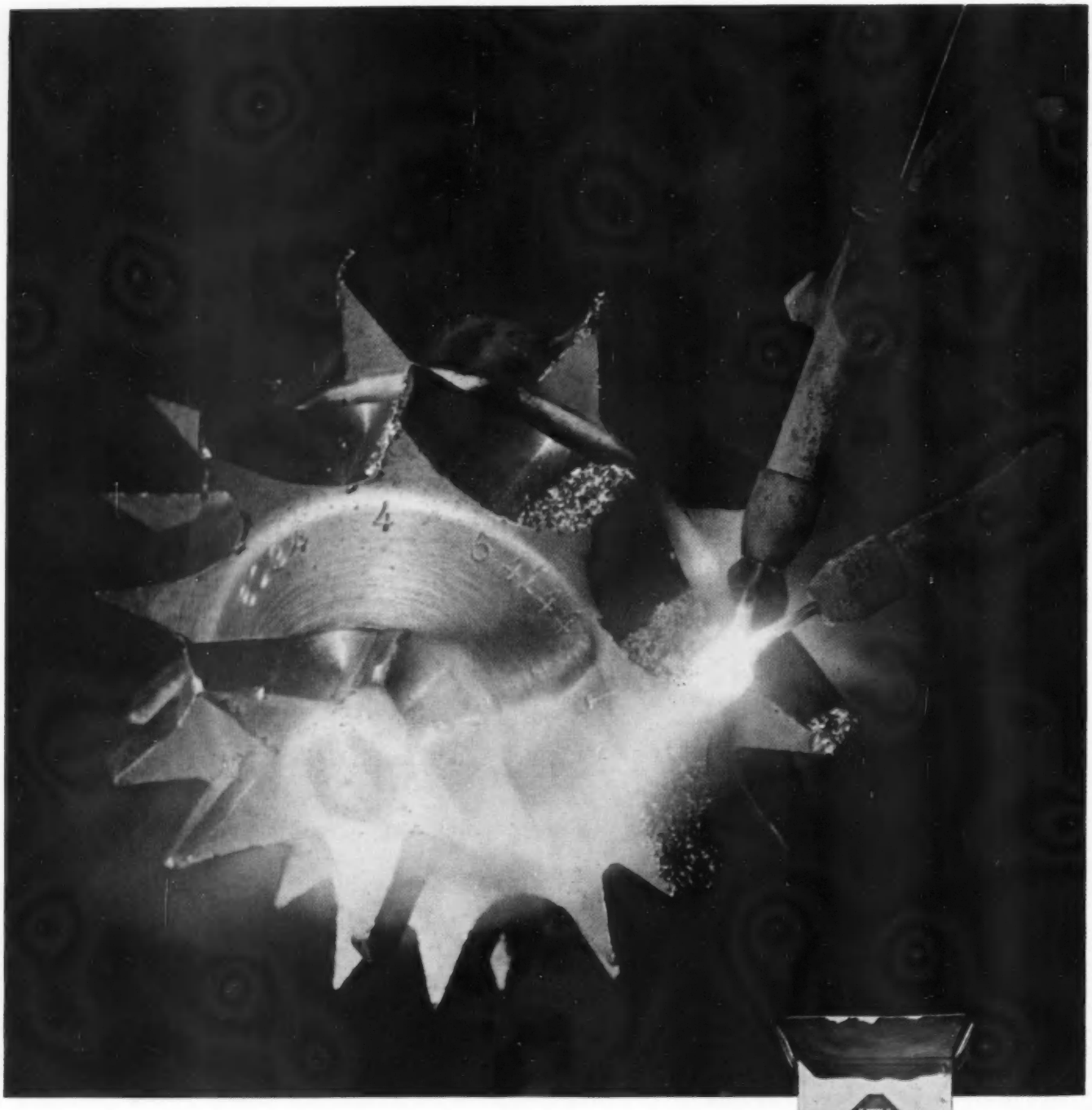

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mixed base, with gravity varying from 21.5 to 35, and is produced from Tertiary sands. Cumulative production to Dec. 31, 1956 exceeded 74 million barrels, including oil estimated to have been produced by the Japanese during the World War II occupation.

Appraisal Wells. Several appraisal wells drilled at Jerudong by British Malayan to determine the extent of the 1955 discovery have yielded discouraging results. The vicinity is intensely faulted, and the sands have been found only poorly productive. Testing was continuing to determine if the field warrants being put on production. Generally, Royal Dutch Shell was pessimistic about onshore exploratory prospects in British Borneo, though optimistic about offshore prospects.

Early in 1957, British Malayan Petroleum Company was liquidated and its assets, including Seria field, were transferred to Brunei Shell Petroleum Company, Ltd. The new company was expected to continue approximately the same rate of drilling maintained in 1956.

The Shell Company of North Borneo, Ltd., is searching for oil in North Borneo, a British dependency separate from Brunei and Sarawak to the southwest. Seismic, gravity and sea-bed sampling activities already have covered about 7000 square miles of the offshore area. Echo-sounding surveys have been made of the ocean floor at selected points.

Shell's drilling program in the South China sea offshore from Brunei and Sarawak was in high gear, with six drilling platforms erected. The first high seas well was spudded in November, 1956, at Ampa Patches, 25 miles off the Brunei coast in 30 feet of water by British Malayan. The test was drilled to 6000 feet and abandoned in 1957. The rig was moved to Siwa, eight miles off the coast of Sarawak 60 miles southwest of Ampa Patches, where Sarawak Oilfields, Ltd., had constructed another platform.

Including wildcats, British Malayan drilled 45 wells in 1956, with eight rigs working during the first half of the year, and seven during the last half.

Refining. Crude oil from Miri field, and a large portion of the production from Seria, is refined at the Lutong Refinery, owned and operated by Sarawak Oilfields, Ltd. There is a 2000-barrel-a-day gasoline plant at Seria, connected by four-inch pipe line to Lutong, 40 miles to the southwest. Lutong was reported running at capacity, charging 50,000 barrels daily at the end of 1956.

West New Guinea. Serious depletion of the three fields now being produced in West New Guinea, a territory claimed by both the Dutch and Indonesian governments, continued during 1956. Total crude production during the year was 2,618,430 barrels, of which 1,743,220 or two-thirds was from Klamano field. Wasian field produced 487,090 barrels and Mogoi, 388,120 barrels.

Cumulatively, these three pools produced at a rate of 7154 barrels daily during 1956, representing a 23.7 percent decrease from the 9365 barrels produced daily in 1955. The decline in production has been going on since the peak year in 1954.

Only four development wells were drilled during 1956, three in Wasian

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West New Guinea Production in 1956

NAME of FIELD	Klamono	Wasian	Mogoi
Year of discovery	1936	1940	1940
Footage drilled during 1956	.....	9,766*	75**
Number of wells completed during 1956	.....	3	1
a) Oil wells	.....	3	1
b) Gas wells	.....	.....	.....
c) Dry holes	.....	.....	.....
Number of wells actually drilling as of 12-31-56	.....	.....	.....
Number of drilling wells suspended as at 12-31-56	.....	.....	.....
Number of flowing wells as of 12-31-56	1	4	.....
Number of pumping wells as of 12-31-56	18	4	24
Number of oil wells shut in as of 12-31-56	.....	.....	.....
Producing depths as of 12-31-56 (in feet)	300-680	2950-3370	1050-1870
Total crude oil production during 1956 in barrels	1,743,220	487,090	388,120
Average crude oil production during December 1956 barrels daily	4,770	1,640	700
Accumulative crude oil production up to 12-31-56 in barrels	14,101,660	972,290	3,885,770
Base of crude	Asphalt	Paraffin	Paraffin
Gravity of crude	18.9	42.8	43.7
Name of producing formation	Klasafet	Klasafet	Klasafet
Age of producing formation	Miocene	Miocene	Miocene
Type of producing formation	Limestone Anticline	Limestone Anticline	Limestone Anticline

*Of which 166 feet included deepening old well. **Deepening old well

and one in Mogoi. All four were completed as oil wells. Two wells, one each in Mogoi and Wasian, were deepened to lower pay horizons. Total footage in development wells amounted to 9841.

The new field found in late 1955 at Seleh, in Vogelkop, has been outlined and determined to have a reserve of about 3 million barrels. Due to the large expenditure necessary to put the field on production, it apparently will not be produced in the near future as it is too small, considering the remote location.

Despite disappointing results from both production and exploration, NNGPM (Netherlands New Guinea Petroleum Mij), composed of Royal Dutch Shell, Standard-Vacuum Oil Company, and Caltex on a 40-40-20 basis, respectively, continued to search vigorously for oil in West New Guinea. During 1956, NNGPM acquired more than 65,000 miles in new concessions in New Guinea.

Helicopters were being used to expedite exploration and drilling in New Guinea. A dry hole drilled late in 1955 at Waipili, a remote location on the small island of Salawati west of New Guinea proper, made history upon evacuation of the last piece of equipment in February, 1956. All the personnel, drilling equipment and all other items essential to the operation were flown in and out carried by helicopters.

Papua. Exploration in remote Papua continued, encouraged by a gas blowout that occurred at Kuru 1 early in 1956. Australasian Petroleum Company, composed of The British Petroleum Company, Standard-Vacuum Oil Company and Australian interests, experienced the first really encouraging event of its 20-year search for oil in Papua when the Kuru test blew out at 998 feet. Surface casing (18⅝-inch O D) had been cemented to 449 feet.

Myron Kinley, high-pressure well control specialist from Houston, was flown to the scene to take charge. The well was cemented off, with some gas continuing to escape around the plug. However, the well did not catch fire.

By mid-1956 a directional hole had been completed and the high pressure formation was safely mudded off. Apparently, no attempt will be made to

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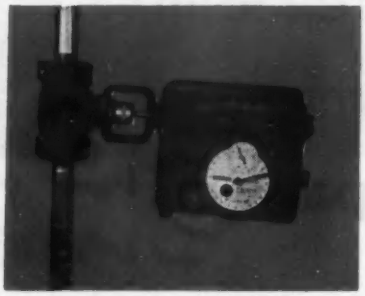

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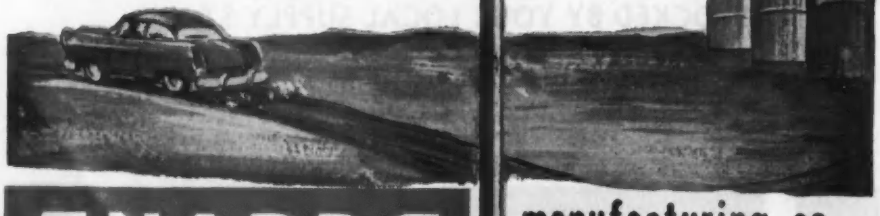

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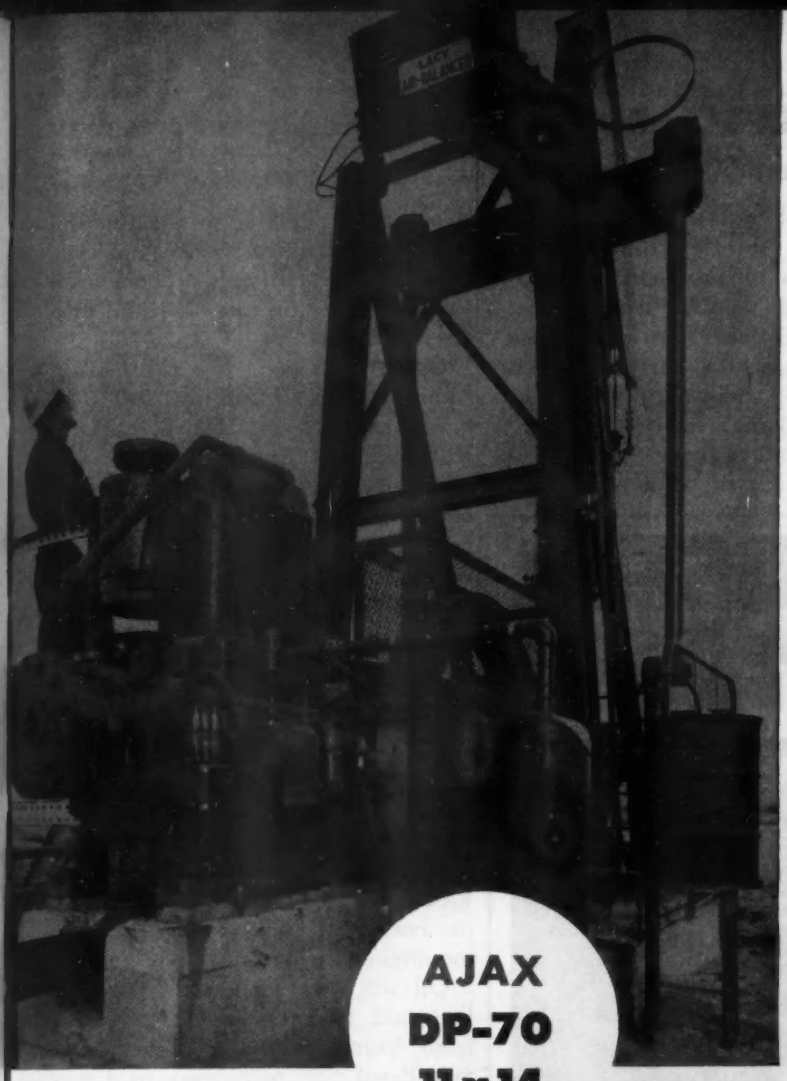

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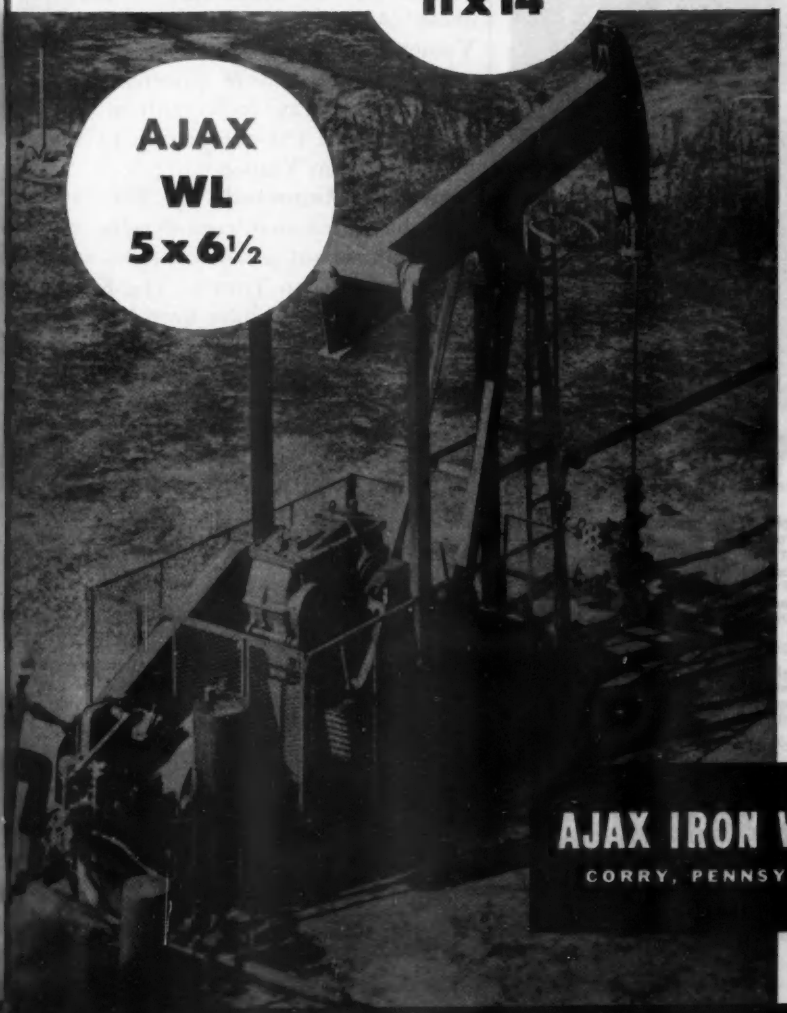

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produce the gas since there is no market. However, the gas may indicate an oil deposit somewhere in the vicinity. More than 85,000 feet of hole has been drilled and over $36 million has been spent in the search for oil in Papua thus far.

Late in 1956, it was reported that Associated Freney Oilfields had joined with Papuan Apinaipi Petroleum Company to undertake oil exploration in Papua, and that a rig would be moved from Western Australia for use in Papua.

China . . . Production rising steadily; reserves may now exceed 500 million barrels.

PRODUCTION AND RESERVES are believed to be steadily rising in Red China. Crude oil production in 1956 was estimated at 23,500 barrels per day, which would give a total for the year of 8,601,000 barrels. Reports of successful exploratory efforts indicate that China's reserves may well exceed 500 million barrels.

However, it will be a number of years before domestic production and refining capacity can satisfy domestic demands. The nation is dependent on foreign sources for most of its finished steel products.

China lacks good roads, railroads, communications, facilities and adequate technical personnel. Russia, Rumania and Czechoslovakia have made efforts to mitigate China's lack of both equipment and personnel, but are limited in the help that they are willing and able to spare. Despite sizable oil discoveries in the past two years, China's pipe line capacity is extremely limited and its refinery capacity is equally inadequate.

Generally, China's crude source areas are poorly located relative to its greatest areas of population, communications and consumption. About half of China's crude yield currently is from a field near Yumen, located 1200 miles inland from the coast off the northwest flank of the Nan Shan mountain range.

Oil will be transported by a pipe line said to be under construction from Yumen parallel to the Great Silk Road 550 miles east to Langchow. A refinery is operating at Yumen and recently was expanded somewhat. Plans were reported for a Lanchow refinery, to be built in conjunction with the completion of the pipe line from Yumen.

New Field Reported. The Red Chinese have released considerable information about a new oil field, said to be larger than Yumen. The Karamai field is said to have been brought in on Oct. 30, 1955. It is located in the Dzungaria Basin in the Sinkiang Uighur Autonomous Region, about 200 miles east of the USSR border.

The location is tremendously remote, lying between the Tien Shan on the south, the Altai Range of western Mongolia on the north, and the Genghis Khan mountains on the west. By April, 1956, Karamai 2 was said to be on production, and the third well reportedly came in a month later. Ten wells capable of oil production were reported completed by the end of 1956.

A single-track railroad was reported to have extended China's rail system from Lanchow to Yumen by July 1956, and the new artery is in

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A guide mounted vertically under the rotary head, and a short distance above the ground, holds the first length of drill pipe, and the bit, vertically and prevents the turning bit from wandering at the commencement of the hole. As drilling progresses the guide serves to reduce whip in the drill string and so assists in maintaining the drilling of a straight hole. Send for illustrated bulletin.

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vigorous use carrying oil tank cars eastward and workers destined for Karamai westward. From Yumen, further extension of the railroad was being pushed through Sinkiang to Urumchi, Wusu and Karamai to the Russian border, where the Soviets were to meet it with a line built from Aktogai, southeast of Lake Balkhash. This would link Red China's rail system with Soviet lines running through southern Siberia, continuing north of Lake Aral northwestward toward Moscow.

Lack of water, sandstorms and other inclement weather conditions are additional handicaps tending to retard operations in Sinkiang.

Oil strikes have been reported also in the Tsaidam Basin, southwest of Yumen and northeast of the Tibetan Plateau, a region nearly as badly isolated as Karamai.

Pakistan . . . vigorous exploration continues.

VIGOROUS EXPLORATORY activity continued in 1956 in both East and West Pakistan, as the struggling young nation continued strenuous efforts to mitigate its shortage of domestically-produced fuels.

During the year, 10.8 million barrels of petroleum products were imported, for a daily average of 29,508 barrels. Domestically-produced crude equaled only one-sixth the volume of product imports. No significant new reserves of oil were found, but a major gas field was indicated at Sylhet in East Pakistan. Total crude production from the old Potwar Plateau area of West Pakistan was 2,114,395 barrels during 1956, for a daily average of 5777 barrels. The total represents a 2.2 percent increase from the previous year when 2,068,000 barrels (5666 daily) were produced.

Attock Oil Company produced the majority of the 1956 yield, the rest coming from wells operated by Pakistan Petroleum, Ltd. The producing fields at Potwar are Khaur, Dhulian, Balkassar and Joya Mair.

Sui Production. West Pakistan's Sui gas field enjoyed its first full year of production in 1956, following completion in April, 1955, of the 350-mile, 16-inch pipe line by Sui Gas Transmission, Ltd., to Karachi. Raw gas offtake during 1956 aggregated 8025 Mmcf, an average of 21,926,229 cubic feet per day.

Natural gas reported actually transmitted to Karachi was 4589 Mmcf, and a total of 2277 Mmcf was delivered to Rohri, Khaipur and Hy-

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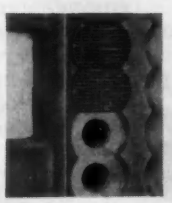

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derabad, along the pipe line route. Volumes of gas entering the line increased gradually during 1956. This year, 7600 Mmcf was expected to be transported to Karachi, with 3940 Mmcf to be moved to the cities already mentioned along the route.

Reserves of the Sui gas field have been estimated at 4 million Mmcf of 975 BTU gas. Sui field was discovered in 1953 by Pakistan Petroleum, Ltd., subsidiary of Burmah Oil Company. Pakistan Petroleum operates the production.

Gas from Sui field is being used for a wide range of industrial and commercial purposes, primarily in electric power generating stations, textile mills, steel re-rolling mills, cement plants, glass factories and ceramics works. It will be both raw material and fuel in a fertilizer plant to be built at Multan.

In East Pakistan, confirmation test of the Sylhet gas field, located 140 miles northeast of the east end of the Ganges River Delta in a remote area near the Assam border, was completed during 1956.

During mid-1955, Pakistan Petroleum, Ltd.'s, first test at Sylhet blew out and caught fire, destroying the rig and other equipment, after the hole had reached 7800 feet. Sylhet 2 was spudded in May, 1956, and was drilled to 9245 feet, confirming a southwest extension of the gas horizon found in the first well. High bottom hole pressures made it inadvisable to drill Well 2 deeper.

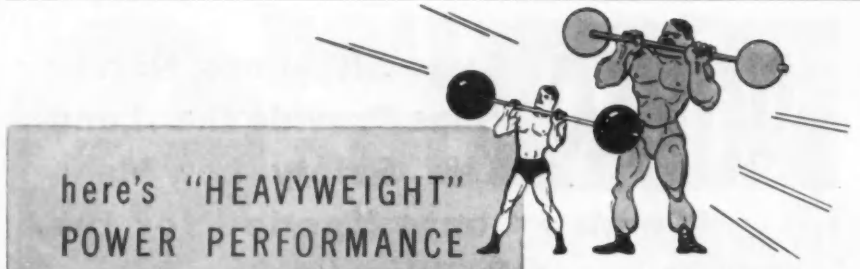
Gas Reserve. A gas reserve of 70 billion cubic feet was considered proved by the two wells, with probable reserves estimated at 300 billion cubic feet. A detailed seismic survey of the Sylhet structure was being undertaken by Pakistan Petroleum early in 1957, and another development well to test the gas horizon was projected.

A high-pressure eight-inch, 145-mile pipe line to transport Sylhet gas to Dacca, near the coast, was being planned.

Other exploration was taking place rapidly elsewhere in Pakistan, with interesting, if less tangible, results. During 1956 Pakistan Petroleum conducted nine party months of reflection work and four party months of gravity meter survey in West Pakistan, and seven crew months of reflection seismic in East Pakistan. Pakistan Petroleum drilled four tests in West Pakistan in 1956.

At Uch, 30 miles west of Sui field, an Eocene limestone was proved capable of large gas production, but the gas contains 46 percent carbon dioxide and 25 percent nitrogen, comprising 71 percent non-combustible ingredients. At Khairpur, 75 miles south of Uch, Eocene limestone, heavily gas productive, was 83 percent by volume composed of non-combustible gases (CO_2 and N) and was abandoned below 8660 feet. Karachi 1 was spudded in August, 1956, and drilled to 7581 feet by the year's end. Adhi 1 was spudded in December and drilled to 814 feet by the end of the year. This test is located northeast of Joya Mair field, south of Rawalpindi.

Pakistan Extension. In addition, an attempted extension was being drilled by Pakistan Oilfields, Ltd., subsidiary of Attock Oil Company, at Dhulian, and had reached 9494 feet at the close of 1956. A test west of Balkassar field at Karsal was drilled to 12,751 feet, a depth record for Pakistan, and plugged back for attempted completion. At Jhatla, southwest of Karsal,



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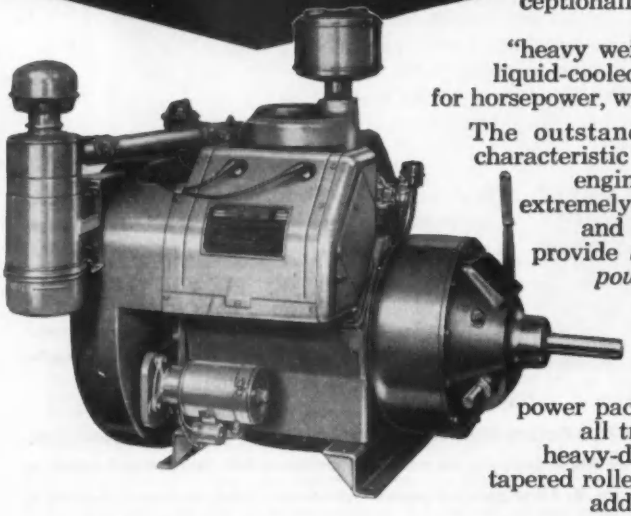

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The outstanding High Torque characteristic of the Model VR4D engine, combined with its extremely rugged construction and heavy-duty stamina, provide *load-lugging holding power,* long life and top power performance.

Advanced "V" design provides an extremely compact power package which includes all traditional Wisconsin heavy-duty features such as tapered roller main bearings plus additional new features.

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Model VR4D Open Engine with heavy-duty clutch, rotating screen, electrical equipment and pre-cleaner.

This new engine rounds out a complete line, comprising 15 models in 4-cycle single cylinder, 2- and 4-cylinder sizes, from 3 to 56 hp. Write for "Spec" Bulletin S-207.

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In most of the areas where drilling, or exploration, are in progress, Paxman diesels will be found, giving unfailing service driving draw-works, rotary tables and slush pumps. These engines come from a range of "Package" sets, developed from 16,000,000 hours of drilling experience, which oil men everywhere know for their sound performance, rugged construction and dogged dependability.

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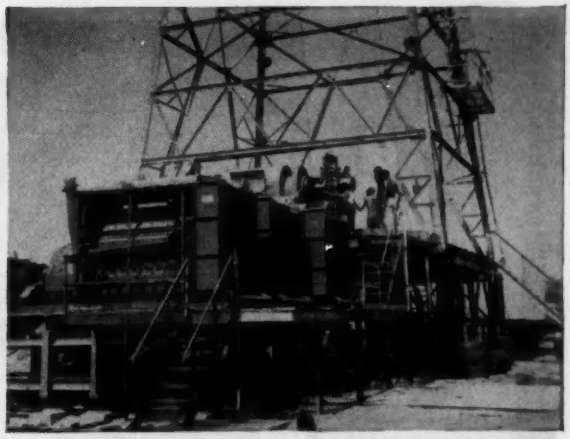
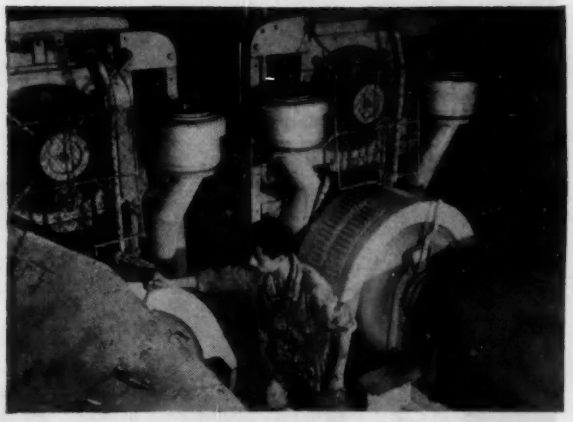


TRUCIAL COAST Shuweihat No. 1 rig with Paxman-engined draw works.

RUMAILA A machine minder at work on the Paxman-engined rig (B.P. photographs)



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JAMBUR A general view of the drilling rig at Well No. 5 Jambur Field near Kirkuk. (From a B.P. photograph)

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a wildcat had reached 6189 feet by the end of 1956. It later was abandoned.

Standard-Vacuum Oil Company completed its first wildcat in Pakistan at Digh in the lower Indus Valley during 1956 as a dry hole at 10,908 feet. A second Stanvac test at Mari, located 60 miles south-southeast of the Sui gas field was spudded Dec. 29, 1956, and was drilling as of mid-1957. Stanvac was scheduled to bring a second rig into Pakistan in June.

Hunt International Petroleum Company drilled its first Pakistan test at Dhak, 80 miles northwest of Karachi along the Arabian Sea coast, on a 25,000-square-mile concession. Dhak 1 was abandoned late in the year at 8414 feet, and Dhak 2 was being drilled nearby early in 1957.

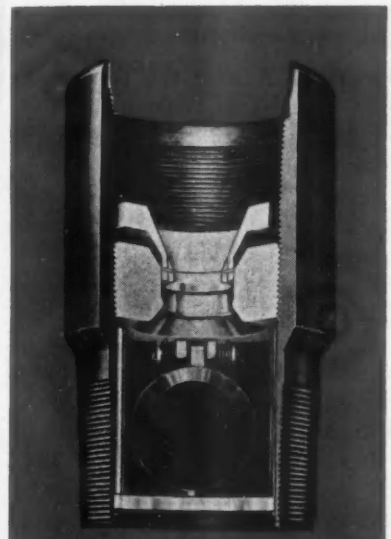
The Royal Dutch Shell group has joined the oil search with the formation of Pakistan Shell Oil Company, which, jointly with private Pakistani interests represented by Petroleum Development of Pakistan, will explore for oil in both East and West Pakistan. Royal Dutch will have a 75 percent interest and the Pakistan group will hold a 25 percent interest in the venture.

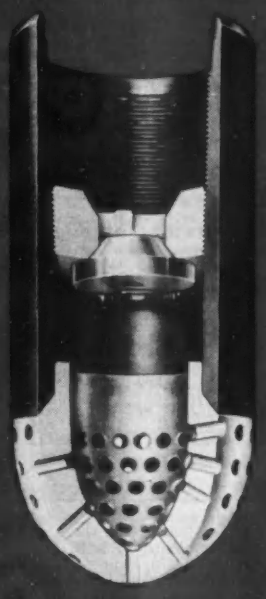
In June, 1957, Pakistan Sun Oil Company, wholly-owned subsidiary of Sun Oil Company of Philadelphia, Penn., was granted a 10,000-square-mile group of concessions, all located in southwest Pakistan. The Government was to participate to the extent of 25 percent of initial exploratory and development expenses. Sun planned to put two surface geological parties in the field during 1957.

Pipe Line Construction. Sui Gas Transmission Company, Ltd., was building a 216-mile, 16-inch, $16 million natural gas line from Sui field to the West Pakistan city of Multan. Completion was scheduled for early 1958. The line is designed to operate at 1070 pounds per square inch. Prime contractor is Pakistan Constructors, subsidiary of Morrison and Knudsen. The line will probably be extended 200 additional miles from Multan to Lahore by 1960. Such an extension would also be 16-inch.

Refining. Pakistan's only refinery, located at Rawalpindi and operated by Attock, ran virtually at capacity during 1956, charging an average of 4973 barrels daily during the year.

For more data on advertised products, use Readers' Service Cards, last page.





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Rector Type "O" is the ONLY automatic casing fill-up equipment that permits circulating the well at your option, and then continuing to run pipe with controlled fill from the bottom. In cementing the well you use standard heads and plugs. The Type "O" collar provides positive shut-off against back-pressure.

If you need to convert from filling to floating, you can do so quickly by dropping in valve-trip ball at the surface and applying pump pressure.

Type "O" Fill Collars and Fill Shoes, used in combination, are priced competitively with other types of fill-up equipment which do not offer the Rector advantages of optional circulating, protective screening nose, and FULLY DRILLABLE ALUMINUM ALLOY all-metal construction. Prompt delivery through your favorite supply store in O.D. casing sizes from 4½" to 13⅜".

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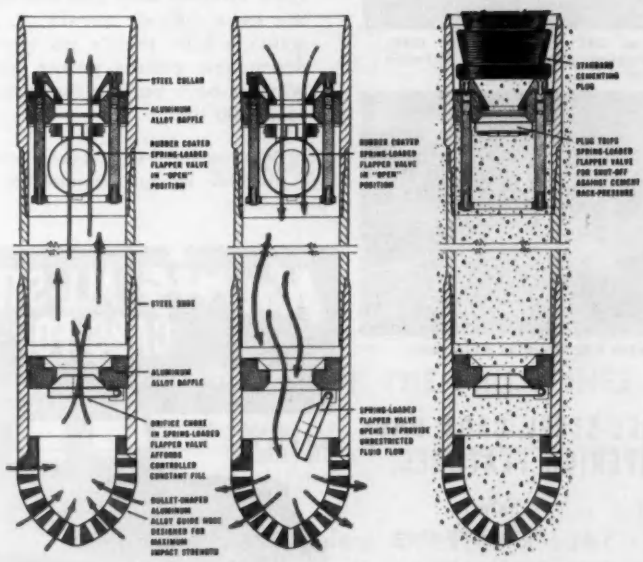
- Spring-loaded flapper valve, with orifice choke, in the baffle assures controlled constant fill.
- Reduces possibility of pipe sticking.
- Converts to float at operator's option.
- Screening nose protects fill equipment from fouling.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Philippines . . .

Private companies intensify exploration and drilling.

THE YEAR 1956 was marked by the most extensive oil exploration so far conducted by private companies in the Philippines, including geological and aeromagnetic surveys of about 6.5 million acres covered by exploration concessions in different islands of the archipelago.

In addition, projected drilling programs resulting from this expanding exploration indicated that the current year would record major drilling activity, possibly establishing a record footage drilled level.

Also indicative of the growing desire to have the country's potential evaluated was the proposed legislation which in 1957 was pending in Congress and designed to clarify and make more definite some provisions of the Petroleum Act of 1949 (Republic Act 387) that originally were expressed in general terms.

Exploration. Among the companies actively engaged in geological exploration during the past year were:

- California Asiatic Oil Company and Texaco Overseas Petroleum Company, which worked jointly in their concession in the Cagayan Basin with a geological party and paleontological laboratory.
- Standard Vacuum Oil Company, which conducted geological and gravity meter surveys in its concessions located in the Cagayan Basin.
- San Jose Oil Company, Inc., which used four geological parties and an airborne magnetometer in exploring the areas covered by its concessions in the Cotabato Basin, Davao and Agusan Valley in Mindanao, Western Iloilo in Panay Island, and Northwestern and Central Luzon.
- Philippine Oil Development Company (PODCO) and Philex Mining Corporation, both of which utilized the services of Aero Service Corporation, Philadelphia, Penn., the firm which conducted the survey for San Jose Oil, for exploration in each of their own concession areas.

The number and size of concessions held in 1956 were:

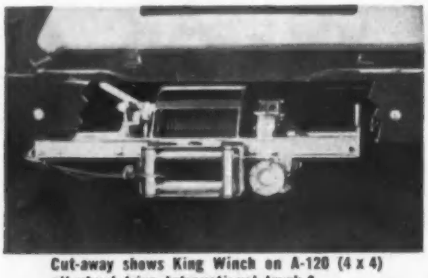
Concessionaire	Area (Acres)
Luzon Stevedoring Co., Inc.	59,843
Philippine Oil Development Co., Inc.	1,429,009
Texaco Overseas Petroleum Co. and California Asiatic Oil Co. jointly	1,233,088
Standard Vacuum Oil Co.	959,615
San Jose Oil Co., Inc.	2,445,544
Acoje Mining Co., Inc.	133,681
Philex Mining Corporation	250,878
Total	6,511,658

In the first quarter of 1956, geological work was conducted on a contract basis for the White Eagle Overseas Co., Inc., a subsidiary of White Eagle Oil Co. of Tulsa. This operation resulted in the company filing applications for exploration concessions in different regions of the country.

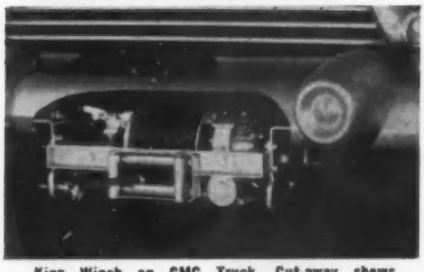
During the year, the following applications were filed:

Applicant	Area (Acres)
Acoje Mining Company	1,255,495
Benguet Consolidated, Inc.	268,181
Philippine Oil Development Co., Inc.	605,583
Republic Resources and Development Corporation	552,780
Royalties, Inc.	223,700
White Eagle Overseas Co.	734,146
Others	526,849
Total	4,166,735

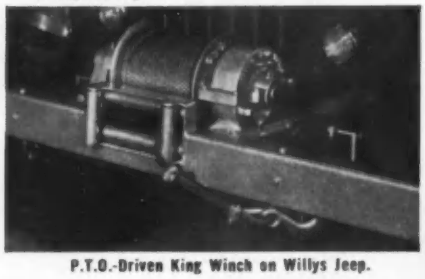
The government, through its Bureau of Mines, continued its recon-



Cut-away shows King Winch on A-120 (4 x 4) all-wheel-drive International truck.*



King Winch on GMC Truck. Cut-away shows underslung mounting, featuring new hi-tensile strength design.



P.T.O.-Driven King Winch on Willys Jeep.

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King Winches keep you moving through the most difficult terrain . . . you get action where there's no traction with dependable pulling power. King power winches have pulling capacities of 8,000 to 19,000 lbs.

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naissance exploration survey and covered southwestern Mindoro. Its Paleontological laboratory services were made available to concessionaires and other private enterprises.

Drilling. Drilling in 1956 was limited to the operations of the Acoje Mining Company and Philippine Oil Development Co. The first drilled several shallow wells of various depths in the vicinity of Algeria, in southern Cebu Island.

PODCO started its Well 1 on the Tumauini structure in the Cagayan Valley in January, and reached a depth of 10,414 feet through Tertiary sediments in September—the deepest well yet drilled in the Philippines. It was abandoned for a better site on the same structure, with the second test scheduled for 1957.

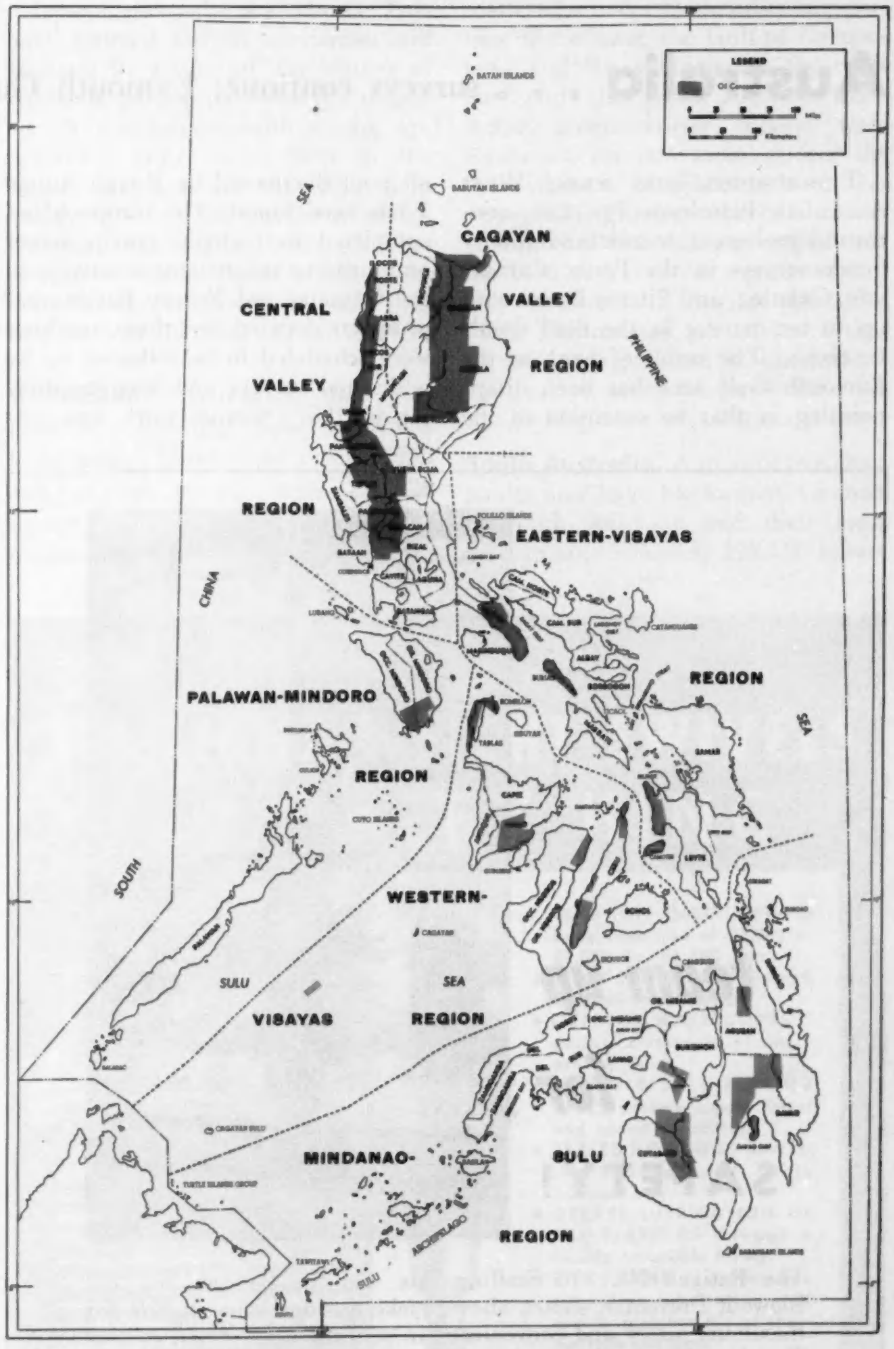
Standard Vacuum Oil Co. conducted detail examinations in preparation for drilling a well on its Concession No. 14 in the Cagayan Valley. And its first well was spudded in on March 23, 1957. The well, Faire 1 on the Faire anticline, was being drilled under contract by Santa Fe Overseas Drilling Company, a subsidiary of Santa Fe Drilling Company of Whittier, Calif.

Acoje Mining also scheduled 1957 drilling operation. The location had not been selected, but likely would be either in the vicinity of Algeria in Southern Cebu, where field investigations were conducted last year, or in the vicinity of Bogo in Northern Cebu, where geological exploration was being conducted in 1957. Machinery and equipment, ordered in 1956, was expected to arrive shortly.

Outlook. With the mechanization of agriculture and the building of more industries, the Philippines now is in an economic transition period. From the petroleum standpoint, this is a good sign since it provides an incentive for the search for oil.

Refining. The Caltex refinery in Batangas, the only plant in the Philippines, recorded daily average runs to stills during 1956 of 13,000 barrels daily. All crude was imported and amounted to 6,257,886 barrels for the year.

The Shell Company (Philippines) Ltd. and Stanvac still were negotiating with the government on plans to build refineries.



PETROLEUM MAP OF THE PHILIPPINES

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Australia . . . surveys continue; Exmouth Gulf area disappointing.

THROUGHOUT THE YEAR, West Australian Petroleum Pty. Ltd. conducted geological, seismic and gravity meter surveys in the Perth, Carnarvon, Canning, and Fitzroy Basins with up to ten parties in the field simultaneously. The result of work in the Exmouth Gulf area has been disappointing in that no extension of the oil pool discovered by Rough Range 1 has been found. The company has completed its regional gravity meter and airborne magnetometer surveys in the Canning and Fitzroy Basins, and prospects located by these methods were scheduled to be followed up by additional surveys and then by drilling in 1957. Seismic work was continuing in the Exmouth Gulf area in an attempt to locate future drill sites.

The present target for Associated Freney's Sisters 1 well is the Devonian limestone which was expected at about 6000 feet. This site was selected after geological field work and seismic surveys in the Sisters Plateau area. The company was not engaged in active exploration elsewhere.

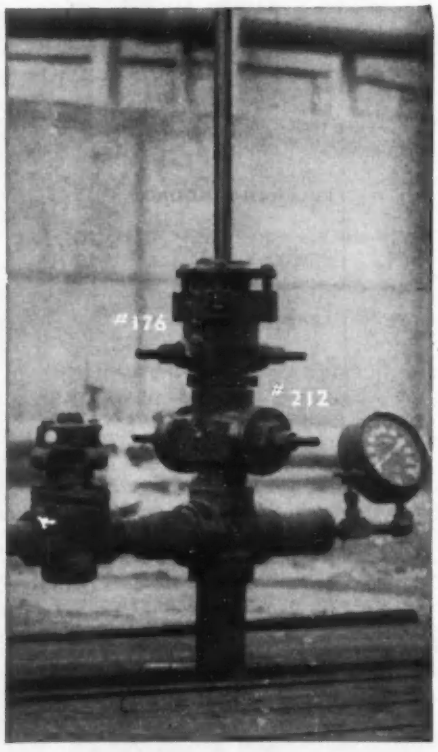
Other holders of permits to explore have conducted little or no active exploration, except, in some cases, reconnaissance and semi-detailed geological surveys over limited areas. The Commonwealth Bureau of Mineral Resources completed its third year of reconnaissance geological field work in the Canning Basin, bringing the total area covered to approximately 200,000 square miles.

For the future, West Australian Petroleum indicated its intention of continuing detailed search activities in 1957 with intensified work in the Canning and Fitzroy Basins. The future of Associated Freney N. L., with restricted finance, may depend upon the outcome of the test well at the Sisters Plateau site. Other organizations are unlikely to speed up their oil search activities in the future.

Western Australia. In the year ending Dec. 31, 1956, Western Australian Petroleum Pty. Ltd. continued as the undisputed leader in the search for oil in Western Australia. The total footage drilled amounted to 54,148 feet after drilling test wells in the Cape Range area, the Rough Range South area, the Frazer River area, and a test well which was in progress on Dirk Hartog Island at the end of the year. Holes for stratigraphic information were drilled at Roebuck Bay and at Dampier Downs. Structure holes were drilled at Rough Range and on Dirk Hartog Island.

Associated Freney N. L. completed its test well on the Myroodah anticline, and commenced another on Dec. 22 on the Sisters Plateau. Both of these are in the Fitzroy Basin. The footage drilled amounted to 1271 feet by year's end.

The Commonwealth Bureau of Mineral Resources completed its hole



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The No. 176 is designed so the polished rod is self-aligning, operating at maximum efficiency at all times. It is the only unit of its kind on the market that receives lubrication direct from the pumping well. Also the No. 176 can be "shut off" while repacking the box.
The No. 212 is comparatively light in weight, yet has 3000 pounds capacity. It is equipped with Ratigan's new type, quick changing retractable rubbers. In addition to its use as a blowout preventer, it also can be used for swabbing or running rods in wells that head or flow, in the course of operations.

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for stratigraphic information at Laurel Downs in March, and by June 7 had completed another at Price's Creek. Both of these localities are in the Fitzroy Basin. The footage drilled amounted to 3817 feet.

During 1956, the following companies held permits to Explore:

West Australian Petroleum Pty. Ltd.; Abo Gold Explorations & Flotations Ltd.; Atom Minerals & Oil Ltd.; Jackson Explorations; Kalgoorlie Goldfields Petroleum N. L.; Westralian Oil Ltd.; West Coast Oil Fields, Ltd.; Norwest Oil Pty. Ltd.; Kimberley Oil Exploration Syndicate Ltd.; and Gulf Oil Syndicate. A total of approximately 407,800 acres have been divided between these companies.

Victoria. Three companies have been actively engaged in oil drilling operations up to the present in Victoria. They are Woodside (Lake Entrance) Oil Co. N. L., Frome Lakes Proprietary Ltd., and Westralian Oil Limited.

Apart from 20,855 feet of deep drilling activity, the Woodside Company has embarked on a shallow scout drilling program to explore the oil possibilities in the Tertiary along the coastal strip from the present deep drilling sites in the Woodside Dunes in South Gippsland in a southwesterly direction towards Corner Inlet and Wilson's Promontory. A light mobile drill with a capacity of 3500 feet was bought for this purpose.

The Woodside Company was granted two new leases in the coastal area, including for the first time in Victoria an offshore area. The company also acquired a controlling interest in Gippsland Oil Co., Ltd., including leases spread out from Rosedale to the Lakes Entrance area.

The Frome Lakes Proprietary Ltd. drilled four exploratory wells in the marine Tertiary of South Gippsland for a total of approximately 4638 feet of drilling. An agreement to exchange information has been concluded between the companies actively searching for oil in Gippsland. This important step is in harmony with the state government's policy placing the fruits of long years of geological research on the part of the Mines Department at the disposal of the companies concerned.

Western Oil Limited was continuing to drill on its Yarram well and had passed 1182 feet.

Recent events in the Middle East have spurred the oil companies still engaged in active oil exploration of Australia to approach the Commonwealth government with strong appeals for more active help in the search for domestic oil. This help could be either in the form of increased geophysical and geological exploration work, or financial aid to the more active companies, on some prorata basis of the effort so far exerted.

Queensland. Geological and geophysical prospecting continued over a large area of Queensland during 1956 and at the present time 256,528 square miles are held under title for prospecting for oil. These areas are scattered all over the sedimentary portion of the state, the Gulf of Carpentaria and the sea between the coast line and the Great Barrier Reef. Aerial magnetometer surveys were conducted on two areas during the year while a considerable area was surveyed by gravity methods.

A total of 91.5 feet was drilled during 1956 with no wells completed and only one well drilling at Dec. 31, 1956. The outlook for 1957 was that further geological and geophysical investigations would be undertaken for the development of wildcat drilling.

South Australia. A total of five companies now have Exploration Licenses in South Australia and their areas total to approximately 222,150 square

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CORING . . . GEOPHYSICAL DRILLING
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miles. Drilling has been conducted by three of the license holders, and by the S. A. Mines Department.

Santos Limited (Oil Prospecting License 13/1) had drilled a total of 14,207 feet. Murray Basin Oil Syndicate, Ltd., had drilled 1216 feet, while Australasian Oil & Gas Corporation Ltd. had drilled 1602 feet. S. A. Mines Department on the Yorke Peninsula had drilled 2881 feet. The S. A. Mines Department was conducting investigations including drilling on central and lower Yorke Peninsula with the object of assessing the oil prospects of the Cambrian rocks.

New Zealand . . . Production gains are modest as exploration activities continue.

DESPITE THE ABSENCE of major crude discoveries, the oil industry in New Zealand last year continued carving out slight advances in its overall effort. Crude production inched upward, natural gas output increased its pace and interest in exploration was continuing.

Egmont Oil Wells Ltd. of New Plymouth, which continued to hold the country's single current Petroleum Mining License, produced about 6000 barrels of oil during the year, an increase of 295 barrels from the 1955 yield of 5705 barrels. This production came from four wells, one less producer than was reported last year.

In addition, Egmont produced 8,008,220 cubic feet of natural gas, slightly more than 2.5 Mmcf greater than the 5,499,720 cubic feet recorded in 1955.

Egmont Oil's crude output—New Zealand's sole domestic source—yielded 1316 barrels of gasoline, 284 barrels of distillate, 1676 barrels of kerosine, 1473 barrels of diesel oil and 1904 barrels of residual oil.

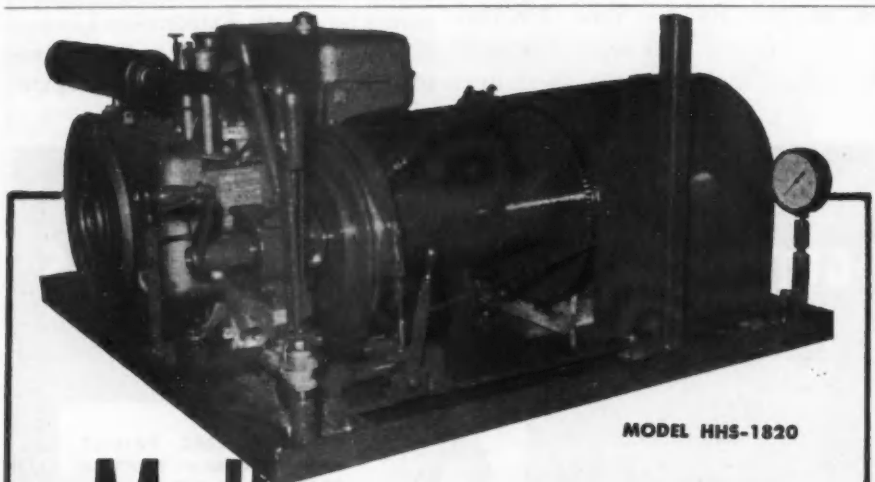
The following areas were held under Petroleum Prospecting Licenses at the end of April, 1957:

DISTRICT	No. of Licenses	Area in Square Miles
North Auckland	10	1,209
Auckland	2	126
Taranaki	32	5,712
Gisborne-Hawkes Bay and Wairarapa	75	13,176
Marlborough	2	135
Canterbury	11	1,974
Otago	1	30
Southland	2	150
Westland	5	490
Total	140	23,002

Shell-D'Arcy and Todd Oil Services Limited continued prospecting in Taranaki, using up to the end of April, 1957, 26 tons of dynamite in exploration operations conducted in shallow holes. These activities have included the drilling of 60,000 feet of hole.

BP Shell and Todd Petroleum Development Ltd. holds 70 of the licenses granted in the Gisborne, Hawkes Bay and Wairarapa districts, and the company has begun exploration operations. A field headquarters was established at Gisborne to accommodate geological and paleontological parties. Geological surveys were under way.

Todd Bros. Ltd. was continuing its geological work in its license areas in this locality.



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Oil and Gas Production in Taiwan

FIELD	CRUDE PRODUCTION		NATURAL GAS PRODUCTION (Thous. of Cubic Feet)		No. of Crude Producing Wells During 1956			No. of Natural Gas Producing Wells During 1956
	Year 1956	Daily 1956	Year 1956	Year 1955	Flowing	Artificial Lift	Total	
Chuhuangkeng	13,741	37	157,795	143,322	..	22	22	1
Chinshui	2,466	7	407,749	409,506	2	..	2	9
Chutung	.....	..	170,509	179,411	..	..	..	4
Shantzechiao	2,263	6	1,586	.....	2	..	2	..
Niushan	.....	..	143,196	138,538	..	..	..	9
Chutouchi	2,649	7	172,496	109,440	3	2	5	1
Liuchunghsi	.....	..	.....	9,312	..	..	..	..
Chutouchi SP	.....	..	.....	17,222	..	..	..	..
Total	21,119	57	1,053,331	1,006,751	7	24	31	24

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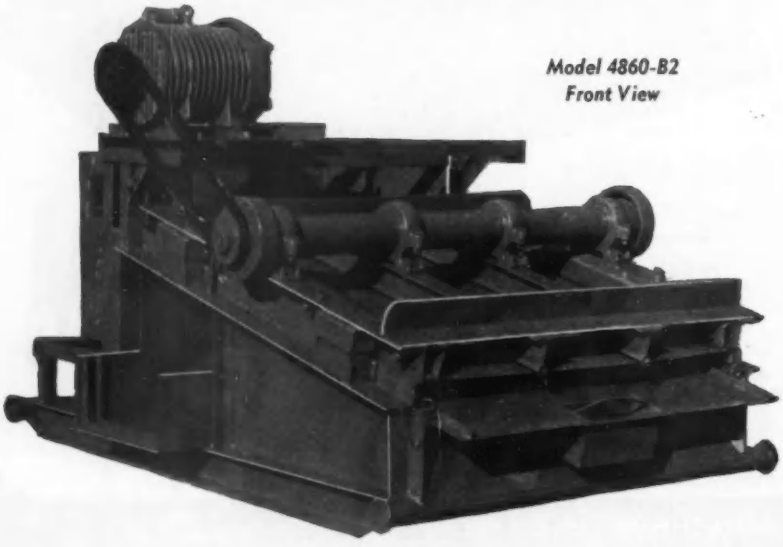

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Taiwan . . .

Unrest clouds oil's future.

FOR THE SECOND straight year, the apparent uncertainty of the future of Taiwan was an obstacle to any possible outside interest in the island's promising oil exploration prospects. This situation existed in 1955 as well as last year despite the passage of a Foreign Investment Law in 1954 designed to encourage foreign capital help in developing the island's resources.

Although the government-owned Chinese Petroleum Corporation undertook every effort within its financial ability to develop Taiwan's oil industry, oil production declined significantly last year.

Crude output of 21,119 barrels—or an average of 57 barrels daily—during 1956 amounted to a decline of 2438 barrels for the year, or 6.7 barrels per day, from the 23,557 barrels or 64 barrels daily, produced the previous year.

Natural gas production, however, climbed last year almost 47 Mmcf from 1955 with total output of 1,053,331,000 cubic feet as compared with 1,006,751,000 cubic feet recorded for the previous year.

Chinese Petroleum Corporation figures record 31 wells as oil producers during the year, seven of which were flowing. Twenty-four natural gas producers also were in production during the year.

At year's end, 12 wells were shut in. During the year, total footage drilled amounted to 28,800 feet, with two wells drilling as the year closed.

Three field wells were completed during the year—one produced oil only, the second yielded both oil and gas and the third was undergoing production tests in March, 1957, with prospects described as good.

Likewise, three exploratory tests were completed in 1956. One was drilled for stratigraphic information, one was a dry hole and the third produced very little waxy crude.

The 1956 daily average runs to stills of the one sizable refinery on the island, located at Kaohsiung, amounted to 23,400 barrels. The plant's crude charging capacity is 30,000 barrels.

Oil Laws Around World Becoming More Favorable

• More countries are showing faith in private initiative, coupled with desire to develop long-neglected oil possibilities.

• But several oil-prospective nations still either prohibit private capital ventures or hesitate to open their doors.

SEVERAL NEW petroleum codes favorable to private capital have become law in foreign nations during the past five years, notably those in Bolivia, the Dominican Republic, Guatemala, Israel, Peru and Turkey. Other countries have amended, clarified and improved their previous oil laws in accordance with the same trend. Still other countries with good oil possibilities—such as Spain, Brazil and Argentina—have continued with the oil business essentially in the hands of the government, assisted only by specialized private firms on a contract basis.

Italy enacted in 1956 an oil law considered very unfavorable toward private capital and discriminatory in favor of the government oil company, Ente Nazionale Idrocarburi (ENI). And Egypt issued certain decrees in 1956 and has carried out a general policy in recent months, both of which becloud a previously clearly-defined petroleum code.

To keep its readers current on foreign petroleum legal trends, WORLD OIL has included articles on this general subject in International Outlook Issues during the past six years, beginning with a thorough analysis in 1951 of the world's petroleum laws. This article offers a thorough summary of new laws and pertinent events modifying and updating the 1951 analysis.

Australia. Australia is somewhat similar to Canada in that petroleum laws vary with the state or province, and are generally favorable to private companies. Late in 1955, the Mines (Petroleum) Act was passed in Victoria. It authorizes a search title, known as a Petroleum Exploration Permit, entitling the holder to preferential right to acquire prospecting licenses in one or more parts of the area covered by the permit. Such a permit may be issued for a maximum of 5000 and a minimum of 1000 square miles. Petroleum prospecting licenses cannot exceed 200 square miles. In addition, a new health and safety subsection has been added to the act.

After more than 50 years of exploration, Australia continued to be a question mark, with good shows being encountered in wells in several areas, but with no commercial deposits yet having been found. However, the oil search continues, encouraged by a generally healthy legal climate.

Austria. Now that the U.S.S.R. no longer dominates the Austrian oil picture, the nation has an opportunity of getting its oil industry on a firmer footing. In the more productive and prospective eastern zone, oil interests run by the Russians from 1945 until the 1955 treaty were turned over to the Austrian state, not to the private interests whose properties were taken over by the Germans in 1938.

In the Eastern Zone, Niogas, a subsidiary of Newag, the Lower Austrian electricity company, has been granted the right to drill in some of the nation's more promising areas in exchange for shouldering the obligation to furnish the Soviet Union with one million tons

Continued on Page 324

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OIL LAWS *continued*

. . . Regulations under Bolivia's 1950 law are published

(6,788,000 barrels) of crude annually in accord with the Austrian Peace Treaty of 1955.

The 'Vienna Memorandum' of late 1955 gives the private companies with pre-war Austrian holdings, including Royal Dutch Shell group, Socony, Jersey Standard, and Van Sickle (Canadian interests) some hope of being returned at least part of their previous holdings. Considerable progress has been made in this direction recently, with exploration rights in Western Austria being offered to several companies with valid claims in Eastern Austria, in exchange for their relinquishing facilities to the government in the areas covered by the treaty.

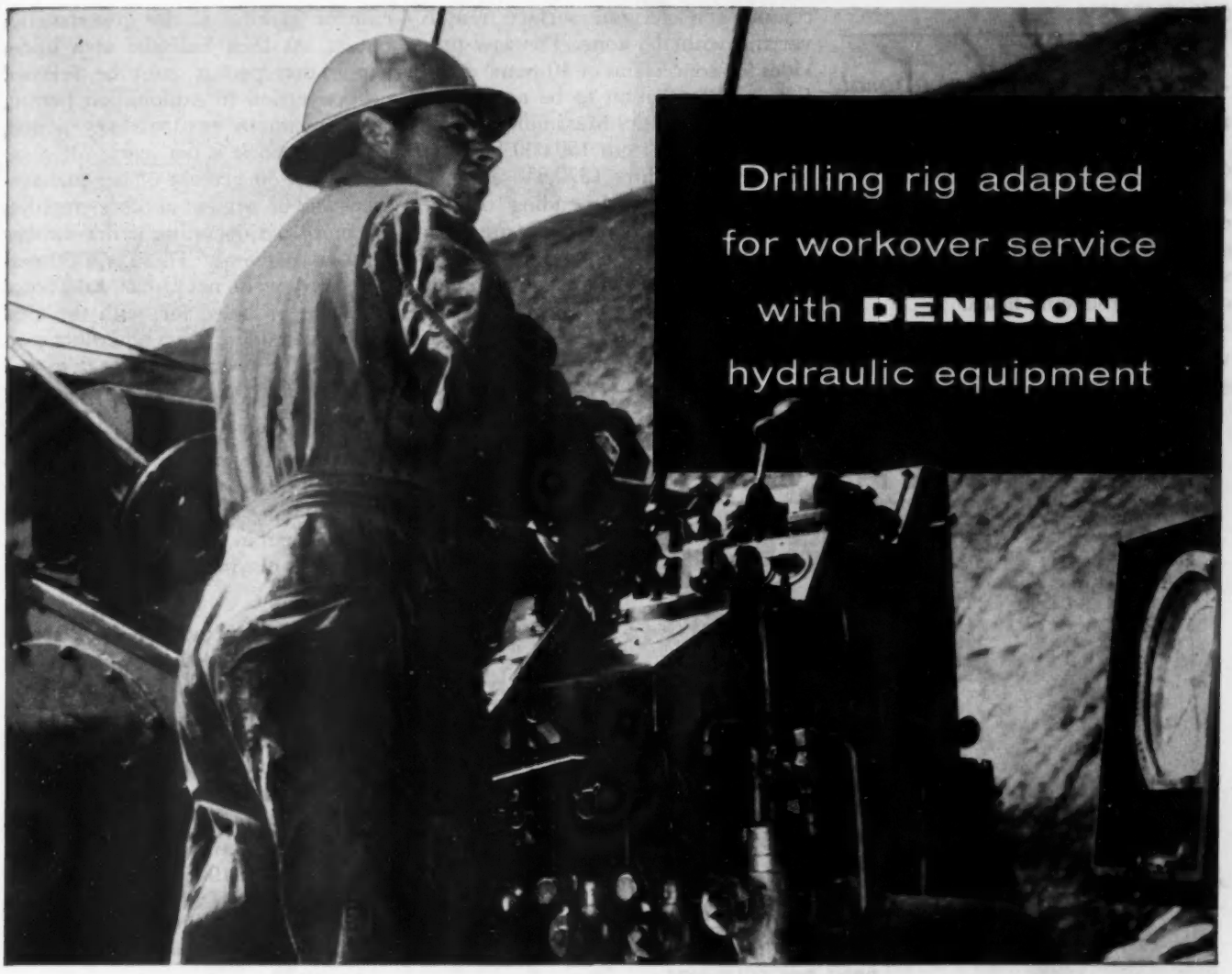
The Austrian government appears to be making a strong effort to be as fair to private interests as its resources allow, while being scrupulously cognizant of treaty obligations to the U.S.S.R. and ever-mindful of Russia's ruthless re-entrance into Hungary.

In the Western Zone, the treaty is not involved and the 1938 Bitumen Law still applies essentially to all oil operations. The state may grant, and already has, assigned exploration permits at its discretion under certain conditions, while retaining a large measure of participation and control. The Austrian government simply has not gotten around to enacting oil legislation more favorable to private industry as yet. And until the Russian shadow fades on Austria, there is little likelihood of change.

Bolivia. A law passed late in 1950 allowing companies of mixed foreign and Bolvian capital to explore in the northwestern part of the country and bids to foreign contractors by Yacimientos Petroliferos Fiscales Bolivianos (YPFB) opened the door in a small way to foreign capital that had been excluded since expropriation in 1937. Clarifications of Bolivia's oil law culminated in the Supreme Resolution Number 68470 of Nov. 3, 1955, and the detailed regulations under the new law were published Jan. 24, 1956.

As with most recent petroleum laws, entities of foreign governments are in-

Continued on Page 326



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. . . *Private capital proposal in Chile is stalled*

eligible for petroleum concessions. The south-central zone, bordering on Western Paraguay and Argentina, and part of Santa Cruz Department are reserved for YPFB. This includes all currently-producing fields.

The remainder of the country is divided into zones, with maximum concession acreage and surface rentals varying with the zone. The law provides for concessions of 40 years' duration, with extension to be considered but not automatic. Maximum concession areas vary from 150,000 hectares to 750,000 hectares (370,650 acres to 1,853,250 acres), depending on the zone. The absolute maximum area that may be held under exploration and exploitation concessions by one company is 3 million hectares (7,413,000 acres).

Maximum royalty on oil and gas production is 11 percent, payable in cash or in kind at the government's option. At least half the area under exploration permit must be released on conversion to exploitation permit. The maximum exploratory period, with extensions, is ten years.

At least 30 percent of the management and 85 percent of other employes of companies operating under the law must be Bolivians. There is a 30 percent fixed tax on net profits. Additional taxes are provided for, with the total of surface rentals, taxes and other payments to the government not to exceed 50 percent of the profits.

Brazil. In 1956, Brazil issued an invitation for foreign capital to develop its varied resources, but oil was notable for its absence insofar as any tangible improvement in the chances for private companies playing a part in oil development.

Chile. Empresa Nacional del Petroleo (ENAP), the Chilean government oil monopoly, boosted production to 7060 barrels daily in 1955 and to 9678 barrels per day in 1956. ENAP appeared to be on firm footing, financially, politically, and personnel-wise.

Nevertheless, legislation was proposed by the executive branch of the government in 1956 to allow private firms to join in Chilean oil development. The proposal later was withdrawn, redrafted, and resubmitted. By mid-1957, such legislation still was under congressional consideration.

However, one proposed amendment would have allowed private capital firms to prospect only in areas north of 52 degrees of south latitude, which would give ENAP a monopoly on Tierra del Fuego. With the exception of Atacama, where some minor indications of oil are reported, Tierra del Fuego is Chile's only prospective oil province.

Colombia. Colombia's oil laws for many years have been generally favorable to private capital, and there have been a series of amendments and clarifications to implement previous legislation. Considerable revision and amending of previous laws were completed with the publication on April 19, 1953, of the New Petroleum Code.

Exploration and exploitation permits were limited to a minimum of 5000 hectares and a maximum of 50,000 hectares (12,355 acres to 123,550 acres); however, particularly remote regions—those east and southeast of

Continued on Page 328

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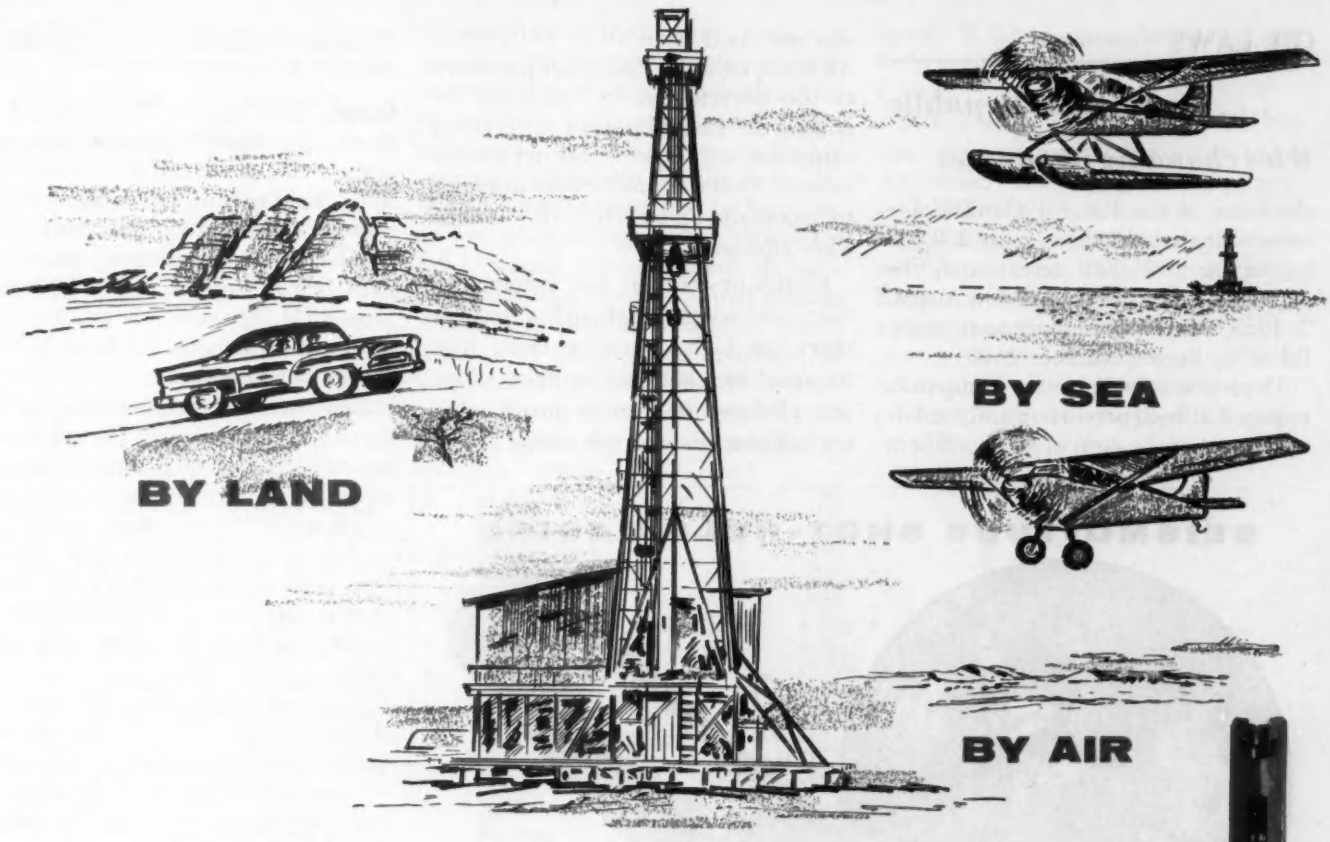

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. . . Dominican Republic tries changing its statutes

the crest of the Eastern Cordillera—were excepted. In these areas 200,000 hectares (494,200 acres) may be granted in each concession. On August 3, 1955, new tax incentives were established by decree Number 2140.

Depletion allowance for companies engaged in both producing and exploration west of the crest of the Cordillera was increased from 10 to 25 percent. All taxes, royalties, and other payments to the government by operators exploring the eastern part of the country cannot exceed 40 percent of net taxable income. Other tax reductions intended to encourage oil search in the Oriente were effected.

Critics of the new law commented that it did not go far enough to provide relief for high operating costs, high import duties, and low depletion allowance; but private firms in the oil industry in Colombia and the nation as well are benefitting from the improvements effected by the new law.

Cuba. The island's Petroleum Law stems from 1938 legislation, with several modifications that have been made since. Exploration concessions are for a three-year term, with no limit to the number of concessions to the same company being effective. But 300,000 hectares (741,300 acres) is the limit for total area of concessions to be granted to any one company.

Exploitation concessions may include up to 8000 hectares (19,768 acres) and are for 30 years, without extension rights. In addition to surface taxes, royalty is set at 10 percent on oil and gas, in cash or in kind at the state's option. One percent royalty goes to the landowner; and royalty to the state is reduced 1 percent on crude refined in Cuba.

Voluntary surrender of permits is allowed at any time. There are very specific forfeiture provisions, violation of concession terms being the sole legal basis for expropriation. No specific taxes apply to petroleum, only the general ones applying to all business requiring payment by the operator. After ten years of operations, non-Cuban personnel must be decreased to a maximum of 15 percent of those employed by the concessionaire.

Dominican Republic. Petroleum Law Number 4532 of Aug. 30, 1956, superseded previous statutes that had failed to attract private capital to the Dominican Republic. The new law reconfirmed indigenous petroleum resources as property of the state that may be developed by private concerns only pursuant to contracts agreed upon by the Executive Power, in the manner and under conditions considered convenient to the national interest.

Exploitation rights are for an unlimited time, covering the area agreed upon. Exploration, production, processing and transportation of hydrocarbons are declared a public utility. Contracts granted by the Executive Power will be submitted to the National Congress for approval and after being approved by the latter shall not be revoked, altered or modified without the consent of both contracting parties.

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. . . Nasser in saddle . . . France changes laws

diction of the courts and the legislation of the Dominican Republic. Foreign governments and sovereigns under no circumstances can obtain rights for exploration and development of petroleum. Obligations and rights of such a contract may be transferred to other persons or entities, other than foreign governments or sovereigns.

Egypt. New 1956 amendments to the Mining Law of 1956 virtually throw its provisions wide open to new negotiation with the government. After reaffirming the franchise of the Suez Canal Company for its operation of the Canal until 1968, Nasser seized the company's facilities only two years after British troops left Suez in the summer of 1954. When directly asked about expropriation of oil, Nasser has said, in effect, that this was not practical. However, properties of Anglo-Egyptian Oilfields, Ltd., have been sequestered as a basis for reparation claims against Britain owing to the Suez attack last fall.

A new law, published in the Official Gazette in January, 1957, empowers the government to control all public and private enterprises in the interest of the national economy. Since, as a practical matter, Nasser now is the law in Egypt, any discussion of Egyptian law (including the Mining Law No. 66 of 1953, which was generally acceptable to private capital but which now is essentially void), would be academic.

France. French petroleum laws have changed rapidly during the past two years. Two sets of decrees were published in 1955—in May and October—clarifying procedures for applying for and granting exploration and exploitation licences. There have been several new laws and decrees since then. The following summary of French oil law was up-to-date as of early 1957:

Two sets of laws govern exploration and exploitation of hydrocarbons, one covering metropolitan France and Algeria, the other covering other French overseas territories. Both sets are similar. Exploration may be conducted on the basis of a *permit* (which is exclusive); development, pursuant to the grant of a *concession*.

The French government may grant a permit by ministerial decree four to six months after the close of public and administrative inquiry. Applicants must prove technical and financial ability to perform exploration, and pledge minimum expenditures per square kilometer, depending on the area involved. Initial permit may be from two to five years, automatically renewable for a second term provided all commitments have been met. Total possible duration of permits, including extensions, is 15 years. Areas involved are automatically reduced by 50 percent at the first renewal and again by 25 percent upon the second permit renewal. If the permitee finds oil or gas, he is entitled to receive a 50-year concession.

Non-French individuals or entities can obtain an exploitation permit or a concession only if a subsidiary, governed by French law, is organized. The capital of such a producing subsidiary must be held at least 50 percent by French citizens. Exploration expenses may be amortized, and the title holder pays no direct tax until production is achieved. The depletion provision and profits split for tax purposes are com-

Continued on Page 332

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. . . '54 Iranian agreement returning oil to markets

bined; the concessionaire may deduct 27.5 percent of gross revenue for tax purposes, or 50 percent of taxable profits, and pay taxes on whichever of the two bases suits him best.

However, funds reserved by the depletion provision must be reinvested in exploration in France or the French Union within five years. In addition to royalties on production that are payable to towns and/or provinces, the French government imposes the following royalty rates on production:

- Nothing on quantities less than 50,000 metric tons* of crude oil per year or less than 300 million cubic meters (10.5 billion cubic feet) of natural gas per year;
- Six percent on quantities between 50,001 and 100,000 metric tons of crude per year and 5 percent on natural gas in quantities exceeding 300 million cubic meters (10.5 billion cubic feet) per year.
- Nine percent on crude oil exceeding 100,000 metric tons up to 300,000 metric tons per year, 12 percent for quantities exceeding 300,000 metric tons per year up to 1 million metric tons annually, and 14 percent above 1 million metric tons of crude per year. Royalties to towns and departments are fixed at 48 francs per ton of crude (about 2 cents a barrel) and 0.036 francs per cubic meter, or about 3 cents per MCF, according to *Le Journal des Carburants*.

*1 metric ton of French crude equals approximately 7.1 U. S. barrels.

Clarification of procedures for filing and acquiring permits has accelerated French exploration greatly.

Guatemala. Guatemala's new petroleum code, issued in 1955, repealed previous legislation dating from 1949 that was untenable for foreign capital. Applicants may request a maximum of ten concessions, with a minimum area of 5000 hectares (12,355 acres) and a maximum of 400,000 hectares (988,400 acres). Exploration permits are for six years, renewable for two terms of two years each. The right to produce oil is included, and a discovery automatically entitles the concessionaire to exclusive development rights. A maximum of 25,000 hectares (61,775 acres) is allowed in each development permit, with 200,000 hectares (494,200 acres) the limit on total development area for one operator.

Development rights are for 40 years, renewable for 20 years provided all conditions of the law have been met. Royalty is 12½ percent in cash or in kind at the government's option, but land taxes are deductible from royalties. The holder of a development permit is allowed five years from the discovery date to define the productive area.

Production must commence within three years from date of discovery, otherwise the licensee may jeopardize his right to produce.

Iran. On Oct. 29, 1954, the Iranian Government and the group of Consortium companies completed an agreement which has now in large measure effected the restoration of Iranian oil to the world's markets. Ownership of oil, both in the Consortium area of South Iran and the rest of the nation, under jurisdiction of the National Iranian Oil Company, is vested in the government. Since much has been pub-

Continued on Page 335

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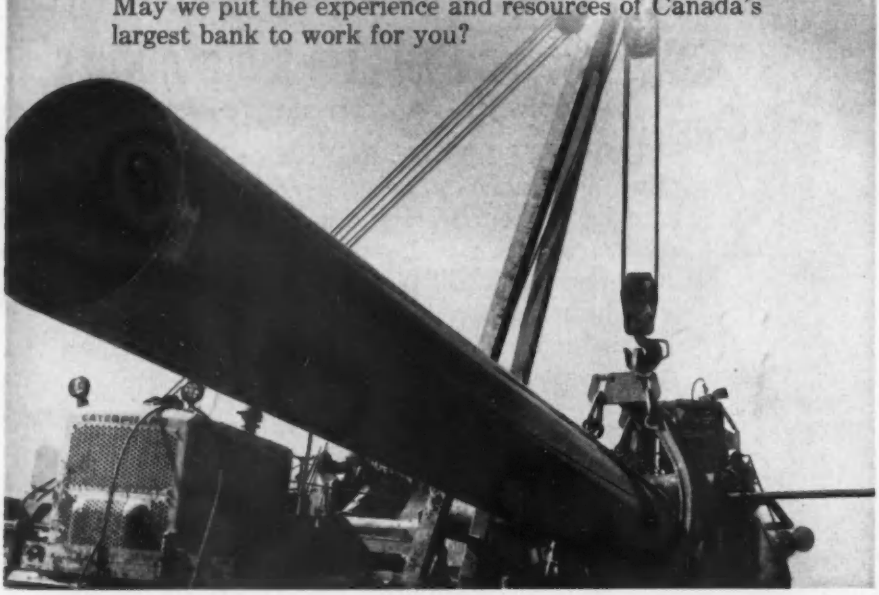
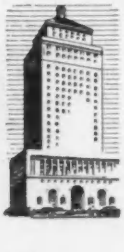


Write to The Royal Bank of Canada, Oil and Gas Department, 409 Eighth Avenue West, Calgary, Alberta, for a list of current "*Oil and Gas Bulletins*". These "Bulletins" are revised constantly, will bring you up to date on regulations, tariffs, oil and gas financing, basic statistics, and kindred subjects.

We do not provide information on oil securities.



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. . . Israel's 1952 law one of the most attractive

lished previously concerning the Consortium agreement, it need not be repeated here since no new oil laws are involved.

Recently, a bill has been reported, seeking to vest authority to grant concessions in the government, without the approval of the Majlis as is now required. This bill was not reported to have been favorably received. However, during the summer of 1957, the Iranian government had sought the services of Elmer Batzell, well-known international oil lawyer of Washington, D. C., who was instrumental in effecting petroleum codes in Turkey, Israel and Guatemala. It appeared that some changes in Iran's laws were in the offing.

Israel. Israel's petroleum law of 1952 is one of the world's most attractive to foreign capital, and due largely to its enactment, the nation became an oil producing country just three years afterwards.

The Petroleum Law 5712-1952 was drafted, largely on the advice of Ball Associates, petroleum consultants of Washington, D. C., the same firm that did basic surface geology in Israel just before the law's adoption. The Petroleum Regulations 5712-1953 supplemented the basic law. Administration of new concessions is handled by the Petroleum Commissioner, responsible to the Minister of Development.

The law provides a three-permit system, including:

- A non-exclusive preliminary geological and geophysical survey permit.
- Intensive exploration license.
- A lease.

The license allows the holder to drill, and a discovery automatically entitles him to a lease, with production rights. A single license may not exceed 100,000 acres, and no one licensee may have more than three licenses nor more than 250,000 acres in any one district. Licenses are for three years, with extensions allowed by the law up to a total term of seven years.

If oil is found, the licensee may have two years to define the field before he must apply for a lease.

Exploration must commence within four months of the granting of a license, and drilling must start within two years and be continuous thereafter.

Leases must not exceed 62,500 acres each nor may any lessee hold more than 187,000 acres under lease in one district. Leases run for 30 years, renewable for 20 years. If a discovery extends the tenure of a license, the lease will be in effect from the date the license would have expired in the absence of the discovery. Royalty to be paid to the government is 12½ percent. Lessees may be required to satisfy domestic requirements before crude or products are exported. Unitization of leases is permitted. Necessary equipment for oil operations may be imported duty-free.

A recent amendment also frees oil companies and drilling contractors operating in Israel from payment of sales and excise taxes on locally produced materials, such as cement and tires, bought for oil exploration and development. Exemption from customs duties was broadened to include drill-

Continued on Page 336

3 *if by air . . .*

8 *if by boat . . .*

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The Canadian Bank of Commerce maintains a complete Petroleum and Natural Gas Department in Calgary, and more than 270 branches throughout Western Canada. For information on any aspect of the industry in Canada, write or telegraph to C. H. Munro, Manager, Petroleum and Natural Gas Department, 309 Eighth Avenue, West, Calgary, Alberta.

(*We regret that we cannot advise on the merits of oil or mining securities.*)

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. . . Italy code limits area of exploration

ing contractors. The new exemptions are retroactive to April 1, 1954, with refunds due to many groups. Provision for a depletion allowance was also effected in August, 1956.

Italy. The Italian Oil Law of 1956 limits the area of each exploration permit to 50,000 hectares (123,550 acres) and the aggregate area of such permits to any one company or individual to 300,000 hectares (741,300 acres). Companies also are limited to 150,000 hectares (370,650 acres) in contiguous exploration permits in the same area. Wherever possible, exploration permits will be in rectangular shape, with the short side not to measure less than one-fourth the length of the long side.

Exploration permits are for three years, which may be extended twice for terms of two years each, provided commitments are satisfied. Prospecting is to start not later than six months from date of notification of granting of the permit, and drilling must commence not later than 30 months after prospecting begins.

Annual rentals must be paid in advance on exploration permits. One-fourth of the permit area must be dropped at the end of the first three years, and another 25 percent must be dropped at the close of the first extension period, unless the permit area is less than 3000 hectares (7413 acres), in which case no such reduction is required.

If the permit holder finds oil or gas in commercial quantities, he will be granted an exploitation, or development concession within the area in which the well is located. The holder must apply for such concession within 120 days of the discovery or face forfeiture. The surface of the production concession may not exceed 3000 hectares (7413 acres), in rectangular form if possible, with the short side not to measure less than one-fourth the length of the long one.

The sides of the concession area shall be oriented in the same directions as that of the exploration permit area. A continuous corridor, one kilometer wide (3281 feet), adjacent to the per-

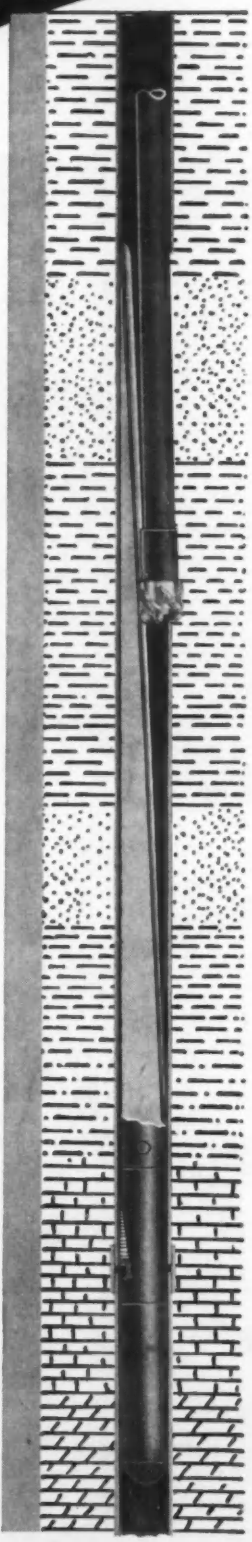
Continued on Page 340

# of Progress

IN THE INDUSTRY

CAMCO MODEL 3
Wireline Truck

NEW KINZBACH SPEEDMILLS Slash DOWN-HOLE CUTTING TIME



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Type 154 Speedmill

TYPE 154 SPEEDMILL
This mill is designed for attachment directly to a Kinzbach Type H Whipstock as the first tool in progressive milling operations. After the Whipstock is set, the attachment bolt is sheared and milling operations can begin. The lug on the face of the Whipstock engages the tapered pilot of this mill, forcing it to cut through the pipe wall without thinning the top section of the Whipstock. The Model 154 Speedmill is used to cut the first two and one-half feet of window only.

Type 155 Speedmill

TYPE 155 SPEEDMILL
After the first stage of window cutting is completed, the Kinzbach Model 155 Speedmill is run to complete the window. This tool is designed to utilize cutting force reactions so that maximum length of window may be cut, while side blades are designed to resist reduction in gage diameter during operation.

Type 159 Speedmill

Type 156 Speedmill

TYPES 156 AND 159 SPEEDMILLS
For general and milling operations. Used to mill up pipe or tools in the well and to shape the ends of obstructing materials for subsequent fishing operation.

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OIL LAWS *continued*

. . . Italian royalty rates are on a sliding scale

imeter of the concession, shall be reserved to the State. No entity is to be granted concession areas aggregating more than 80,000 hectares (197,680 acres). The duration of the concession is 20 years. After expiration of two-thirds of that period, the holder is entitled to receive a ten-year extension, provided he has complied with all obligations.

The concessionaire is required to pay the State in advance for each year of the concession's duration 1500 Lire for each hectare of the concession area.

Royalty rates on crude to be paid to the State are on a sliding scale as follows:

0 to 4 tons* per day, 2.5 percent; 4 to 8 tons daily, 2.5 percent of the first 4 tons and 5 percent of the excess; 8 to 16 tons daily, 2.5 percent on the first 8 tons and 14 percent of the excess; and so forth, varying up to 2.5 percent on the first 128 tons of a 128-256 tons daily well and 21 percent on the excess. If the well makes more than 256 tons daily, the State's royalty is 2.5 percent on the first 256 tons and 22 percent of the remainder.

For natural gas, the same rates apply, assuming one ton of oil to be the equivalent of 1200 cubic meters (42.4 MCF) of gas. Handling and management of royalty oil and gas will be done by ENI.

Areas reserved to the state and those becoming available through being dropped, forfeited, etc., will be auctioned off. Bids may be made by Italian nationals and corporations with head offices in Italy. ENI, and service firms working with ENI, are not allowed to tender bids at such auctions.

The law applies to exploration permits in effect on the date of its entry into force. Such permits will be forfeited if holders fail to re-apply for them within 90 days of enactment of the new law.

Separate concessions and permits may be granted to confer deep rights if the holder complies with all commitments and does not wish to, or can-

*1 metric ton of Italian crude equals approximately 7.5 U. S. barrels.

Continued on Page 342

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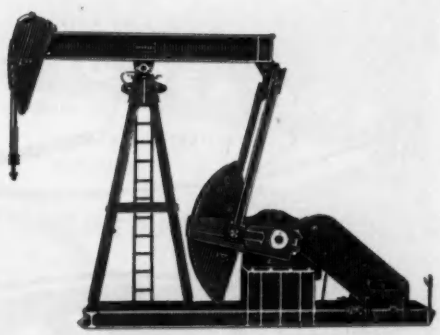

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OIL LAWS *continued*

. . . Libya's new law getting results in a hurry

not, explore for the deeper formations.

Obviously, the Italian law is in a class by itself. Gulf Oil Corporation pulled out of Italy almost immediately after it became law. Other companies still are studying it, being uncertain as to exactly what its effect will be.

Libya. During 1955, Libya, having graduated from U. N. trusteeship status to full autonomy, enacted a favorable petroleum law that already has resulted in more than one-fourth of its large land area being subject to exploration concessions.

A Petroleum Commission, to appoint a Director of Petroleum Affairs, is provided for by the law. Four zones are delineated—(1) Tripolitania, (2) Cyrenaica north of the 28th parallel, (3) the rest of Cyrenaica and (4) Fezzan.

Concessions shall be granted for 50 years (or less if the application so requests) renewable for one period, the two periods not to exceed 60 years as a maximum. Each company may hold a maximum of three concessions in each of the First and Second Zones and four concessions in each of the Third and Fourth Zones, subject to certain conditions.

Total areas allowed one operator are 30,000 square kilometers (7,413,000 acres) in each of the First and Second Zones and 80,000 square kilometers (19,768,000 acres) in each of the Third and Fourth Zones. Within a five year period from the date of a concession, the holder will reduce it in size by 25 percent and by half within eight years. The entire concession may be forfeited at any time by giving the Commission three months notice in writing.

The law provides a flat 50-50 split in profits between the operator and the government, no more and no less. The operator is exempt from certain export and import duties, and has the right to build refineries, or to export crude, subject to consultation with the Commission. Any disputes with the Commission are to be settled by arbitration.

Peru. In 1952, Peru, faced with declining reserves and a Mining Code

Continued on Page 344

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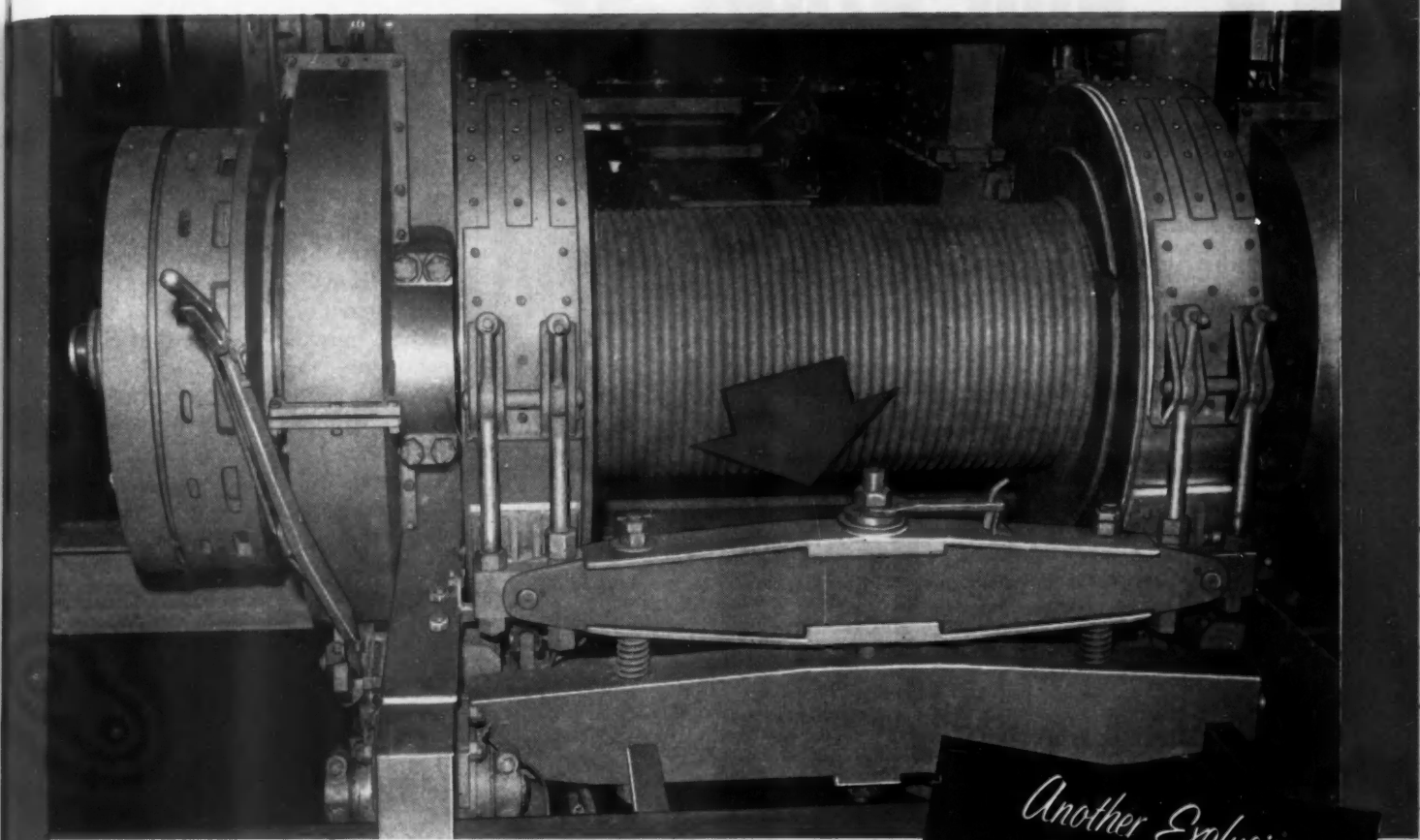

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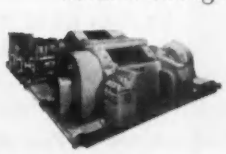

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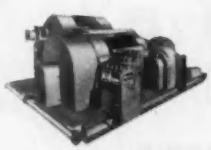

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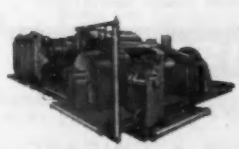

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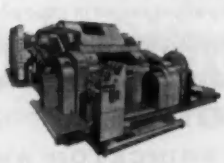
13,000 Ft.—3½" Drill Pipe



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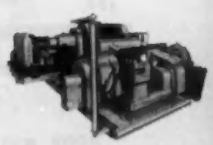

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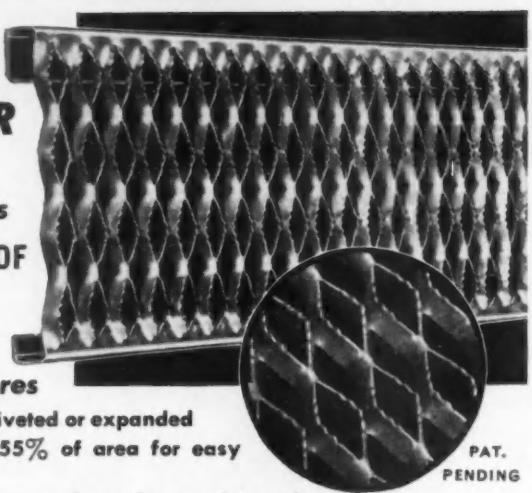

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★ All bars are load carrying bars including secondary bars
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. . . Liberal Philippines' law of '49 beginning to bear fruit

dating to 1922 that included some provisions detrimental to development of the oil industry, enacted a new oil law particularly intended to encourage exploration in the Oriente, the largely undeveloped area east of the Andes.

The law provides for 50-year concessions in the Oriente, with 12½ percent royalty for the first 20 years, to average 34 percent over the entire term. There is a 27½ percent depletion provision for production in the Oriente. Fifty percent of exploration concession acreage must be forfeited after five years.

No foreign exchange restrictions affect operations under this law, and profits may be exported after tax requirements have been met. Participation by companies owned partly or wholly by foreign governments is forbidden. Exploration concessions may aggregate a maximum of 50,000 hectares (123,550 acres) in the Oriente and 20,000 hectares (49,420 acres) elsewhere in the country. As many as 60 exploration concessions could be requested and granted to one applicant, 20 each in Oriente, Coastal and Sierra Zones.

Philippines. A liberal oil law was enacted in 1949, which is bearing fruit now with vigorous concession, exploration and drilling activities.

Some amendments are being considered. One would assure extension of an exploration concession to a holder who has complied with all features of the contract. Another would allow concessionaires to export, duty free, equipment which they had originally had to import to carry on oil or exploration operations. A third proposed amendment would provide a system of arbitration of disputes, and a fourth would authorize the transfer and assignment of concessions under certain conditions.

Switzerland. According to the Swiss Federal Constitution of 1874, mining law belongs entirely to the jurisdiction of the cantons, or states. Not all of the cantons have enacted mining legislation, and those which have done so have limited themselves to rudimentary

Continued on Page 349

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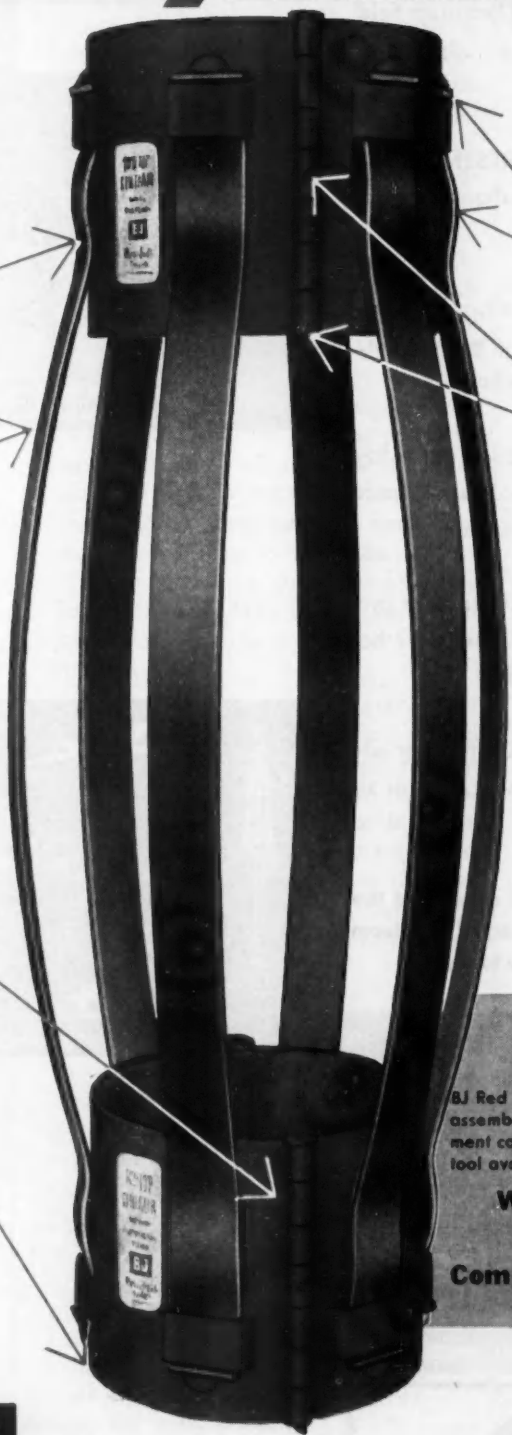
End cages can't hit well bore, regardless of side load.

Choice of 1¼", 1½", 1¾" or 2" (color-coded) cambers.



Cambers dimensioned before pre-stressing and assembly. You always get the required assembled o.d.

Positive double retaining feature locks pin with dimple in middle and bend at end.

End of spring is curved so spring-holder can never hit wall.

Self-aligning, weld-on type stop collar furnished for use when centralizer is not located on casing collar.

Big Savings

BJ Red Top Centralizers can be shipped disassembled, offering big savings on shipment costs—particularly for export. Assembly tool available.

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SEISMIC SURVEYS — Experienced SSC contract field crews are available for seismic prospecting . . . "wherever oil must be discovered."

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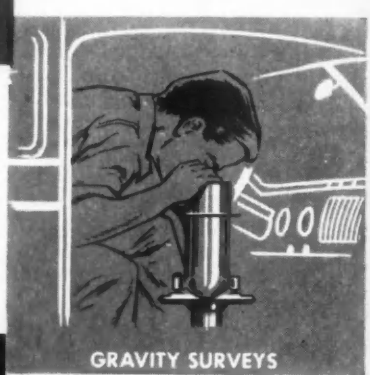
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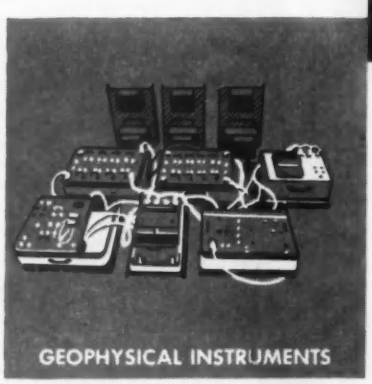
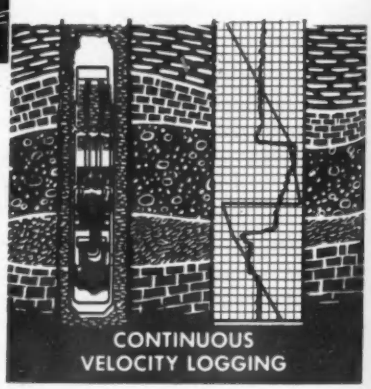
SSC is equipped with the experienced crews and the exploration tools necessary for the discovery of petroleum . . . *anywhere.* SSC is ready to serve you *today.*


GEOPHYSICAL INSTRUMENTS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BAY CITY, TEXAS
J. P. Graham.....CI 5-4526
BEAUMONT, TEXAS
Assoc. Eng. & Eqpt., Inc.....TE 5-7046, ZF 8-2023
CASPER, WYOMING
C. A. White.....3-5264
FORT MORGAN, COLORADO
C. A. White.....918
GLENDIVE, MONTANA—C. A. White..EM 5-3833
HOBBS, NEW MEXICO
Morne Well Service Co.....3-5396
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Assoc. Eng. & Eqpt., Inc.....CA 5-1103
KILGORE, TEXAS—B. M. Davis.....5541
LAFAYETTE, LOUISIANA
Assoc. Eng. & Eqpt., Inc.....CE 5-6770
LIBERAL, KANSAS—Rainbo Service...Main 4-3598
MIDLAND, TEXAS
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NEW ORLEANS, LOUISIANA
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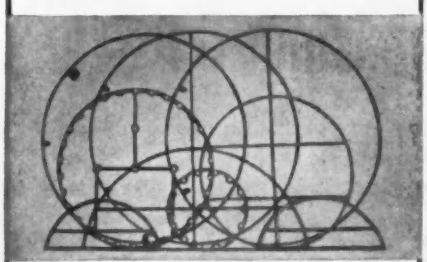
Need GASKETS for HEAT EXCHANGERS?



Call CHICAGO-WILCOX for PROMPT DELIVERY

Here is a dependable source for gaskets for heat exchangers. These gaskets can be made in any size or shape as needed—cut from solid metal, sheet-packing; also double jacket type.

Send specifications, blue prints or templates, for quotation and a prompt-delivery schedule for normal stocking orders.

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OIL LAWS *continued*

. . . Turkey follows liberal example set by others

laws only. Since 1950 a number of companies have filed applications with cantonal governments, requesting oil exploration concessions, and there is considerable current interest in Switzerland in the enactment of canton laws that would encourage and implement the search for oil, retain cantonal rights, and still afford interested companies some sort of continuity in the laws from one canton to another.

On Sept. 24, 1955, Cantons Zurich, St. Gallen, Argovie, and Thurgovie, all located in northeast Switzerland and representing a contiguous area, made an intercantonal agreement to grant identical exploration and exploitation concessions. At least 75 percent of the capital of any such concession holder must be held by Swiss nationals. The four collaborating cantons agreed to grant a concesion covering the entirety of their territory to Schweizerische Erdol AG (SEAG) of St. Gallen, a joint stock company created in November, 1956.

It appeared likely that new Swiss cantonal laws and agreements would follow the above example and require that more than 50 percent of the capital of concession holders be in Swiss hands. The Swiss are not in sore need of outside capital; in addition, they are in a position to provide a large proportion of their own technically-skilled personnel.

Turkey. Before enactment of the Petroleum Law of the Republic of Turkey of March 16, 1954, private companies could operate in the country only on a contract basis. The government company ran the oil business, but lacked money and equipment to do the job properly.

The new law, and the highly detailed Regulations for Administration of the Petroleum Law published in the Official Gazette on Sept. 13, 1955, follow the general pattern of other recent liberal oil legislation. This legislation has succeeded in drawing many applications and resulting concessions to Turkey, to be followed by exploratory tests by private companies now drilling, or preparing to drill.

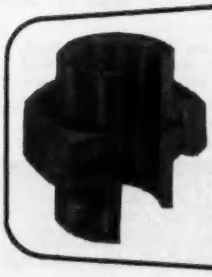
The 1954 law forbids companies in which a foreign government has an

Continued on Page 350

Catawissa PERFECT SEAL Unions

HOT FORGED from solid, rectangular steel bars, designed and produced for dependable, long-life service under the severest piping conditions!

A TYPE FOR EVERY USE!
FOR ALL PRESSURES!
FOR ALL TEMPERATURES!



Standard & Double Extra Heavy
UNIONS
Available with screwed or socket weld ends. 3000-lb. sizes ⅛" to 3"; 6000-lb. sizes ⅛" to 2".

ORIFICE UNIONS
With screwed or socket weld ends. 3000-lb. and 6000-lb. service.

MALE & FEMALE UNIONS
With steel-to-steel, bronze-to-steel, stainless steel-to-steel or orifice seats. 3000-lb. service only.

Standard & Double Extra Heavy
LUG NUT UNIONS
Hammer-type for quick opening and quick closing.

WRITE FOR CATALOG 56
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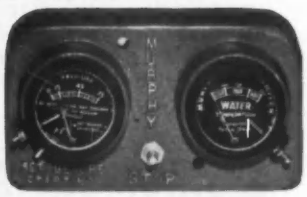
Safety Switches Protect All Unattended Oilfield Engines

MURPHY Automatic Switches Are All You Need

NEW MODEL W-275 for Single Magneto Engines



Featuring new automatic lube oil disconnect switch. Pushbutton sets lockout. Normal oil pressure automatically resets switch when engine is started.

Model W-275-D, slightly larger panel, provides space for #101-D instant snap switch for dual magneto engines.

All Murphy controls are heavy duty, field-tested, made of finest materials, guaranteed one full year. Low-cost replacement parts quickly available.

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Waukesha MOTOR

GAS ENGINES

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NEW TRIPLE IGNITOR

SPARK PLUGS

Waukesha is now factory-installing STITT New Triple Ignitor Spark Plugs in all gas engines . . . STITTS cost a little more—save hundreds of dollars per engine per year because they last longer, cut downtime substantially, increase magneto life, require less service. Also, factory equipment in Clark, Cooper-Bessemer, Worthington, other leading engines.

Write today for new Application Chart—matches spark plug recommendations to engine service —you'll get better plug performance.

STITT

STITT IGNITION CO

COLUMBUS 1, OHIO

STITT MAKES HEAVY DUTY, INDUSTRIAL-TYPE PLUGS!

OIL LAWS *continued*

interest from participating, but negative restrictions seem to end there. Non-exclusive permits may be granted for geological investigation by the Petroleum Administration. An exclusive license gives the operator the right to prospect, drill and produce, and to apply for a lease after making a discovery.

However, a license may not exceed 50,000 hectares (123,550 acres) in area. One operator may hold as many as eight licenses in the same district concurrently. Licenses are for six years, and may be extended for up to two years at a time, with total tenure not to exceed ten years. The licensee must start exploratory drilling on one of his licenses within the same district within five years of the date of his oldest license in that district.

Leases confer the right to produce oil throughout the term of the lease, usually 40 years. The limit of area that one lessee may hold at the same time in one district is 150,000 hectares (370,650 acres). A lease will lapse in 3¼ years if no petroleum has been produced.

Unitization is permissible with the approval of the Petroleum Administration. Royalty on production is one-eighth, payable to the government in cash or in kind. A license may be forfeited by the holder on one month's

Concluded on Page 352

PERFORATE TUBING IN THE WELL

KINLEY TUBING PERFORATOR

M. M. Kinley Company
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CASPER, WYOMING—C. A. White 3-5264
FORT MORGAN, COLORADO—C. A. White ... 919
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HOBBS, NEW MEXICO
Horne Well Service Co. 3-5396
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HOUSTON, TEXAS
Assoc. Eng. & Eqpt., Inc. ..... CA 5-1103
KILGORE, TEXAS—B. M. Davis 5541
LAFAYETTE, LOUISIANA
Assoc. Eng. & Eqpt., Inc. ..... CE 5-6770
Cameo, Inc. ..... CE 5-3124
LIBERAL, KANSAS
Rainbo Service ..... Main 4-3598
MIDLAND, TEXAS
Lucoous Service & Eqpt. Co. ..... MU 2-1631
NEW ORLEANS, LOUISIANA
Assoc. Eng. & Eqpt., Inc. ..... VE 5-4083
OKLAHOMA CITY, OKLAHOMA
Rainbo Service Co. ..... ME 4-2131, ME 2-3045
PETTUS, TEXAS
Eddie Jones Eng. Co., Pettus 16; Beeville, FL 8-1218
SHREVEPORT, LOUISIANA
Cameo, Inc. 8-3615
VICTORIA, TEXAS—Cameo, Inc. ..... HI 3-9521
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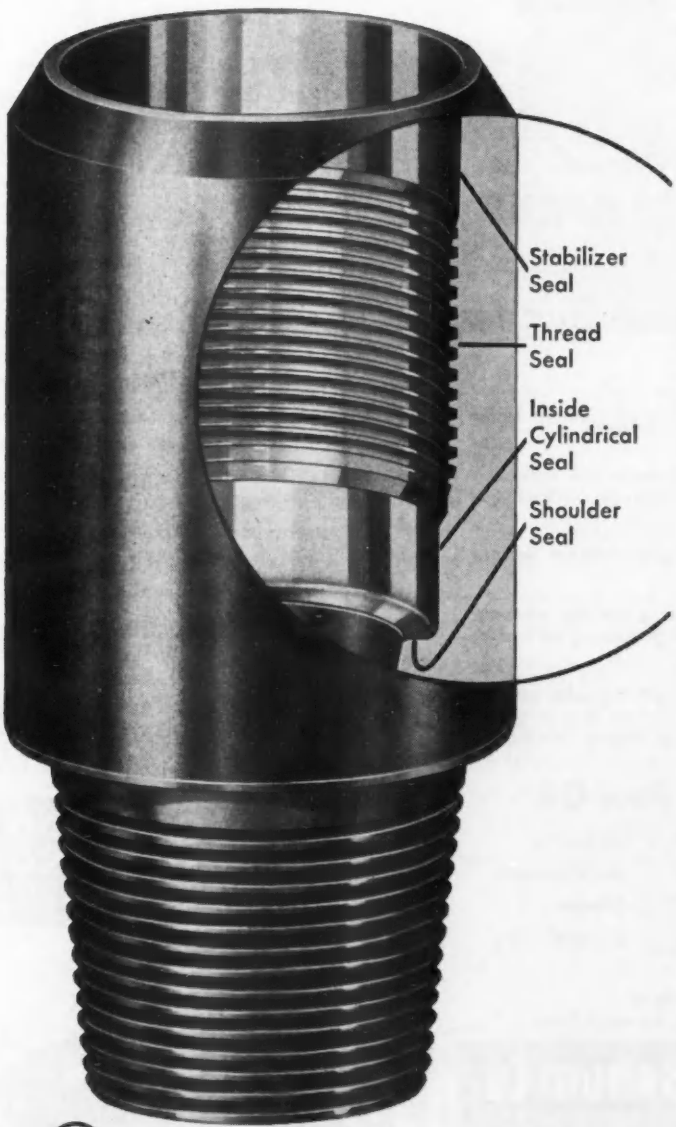
SEE YOUR DEALER OR ORDER DIRECT:

Quick-Fill Corp., 1927 Edmundson, Houston 3, Texas

Men who know tool joints . . . specify American Iron *Straight Grip*



"*Knowing*" tool joints doesn't necessarily mean knowing tool joint technology, even though, with Straight Grip, service in the field is a direct result of proper design and research by the manufacturer.

Knowing a tool joint means knowing and depending on what it will do under all conditions, good and bad . . . knowing that it will not torque off; that under extreme high pressures the pipe threads will hold a seal; that the tool joint will withstand more punishment than the pipe; that quick replacements are available and will be installed at the rig . . . and knowing that Straight Grip is the finest available.

Men who *know* tool joints specify Straight Grip from experience. Longer life, trouble-free operation, additional footage at less per-foot cost, plus the guarantee of satisfaction because it's American Iron.

When you make *your* next tool joint purchase, specify American Iron Straight Grip . . . you'll be buying experience and reliability.

AMERICAN IRON & MACHINE WORKS CO. INC. · MANUFACTURERS OF · A · OIL FIELD EQUIPMENT · OKLAHOMA CITY ·

Another AMF Product
PETROLEUM EQUIPMENT

AMERICAN IRON & MACHINE WORKS COMPANY, INC.—Oklahoma City, Okla.—Subsidiary of AMERICAN MACHINE & FOUNDRY COMPANY

For more data on advertised products, use Readers' Service Cards, last page.

BRIGHT PROSPECT FOR "PIPE DREAMS"

Drillers' "pipe dreams" are of rugged dependability. Producers' "pipe dreams" are of consistent high quality. Both are dreams of economy. And both could well be dreams of FBT seamless †casing, †tubing or †drill pipe whose in-the-field performance has won praise from qualified oil men. For outstanding service on outstanding tubular goods, contact Texcon for FBT.

**Finest Buy in Tubular Goods.*

TEXAS CONTINENTAL TUBE COMPANY

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"SAND-BANUM has done Such a good job for us."

#1 "Your product certainly is the answer to satisfactory boiler operations."

#2 We have been using it in both our large old fashioned boilers and our new Clayton Steam Generator without any other treatment whatsoever.

We have even stopped using a water softener in our operations."

#3 The above candid comments are from a canning company which needs clean, economical steam for processing as well as power.

We invite you to test Sand-Banum (pure colloidal concentrate) in your own operations on our "Better than a money back guarantee." Ounces only once a week remove and prevent boiler scale and corrosion.

To ALL Grades of Fuel Oil

#4

Instant Acting

SABANOL

THE HOMOGENIZING FUEL OIL TREATMENT

Imparts Maximum Clean Burnability

Stocked by Leading Supply Houses

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AMERICAN SAND-BANUM CO. INC.

ESTABLISHED 1926

MEADOW BROOK NATIONAL BANK BUILDING

FREEPORT, NEW YORK

SAND BANUM

. . . Venezuelan developments are of major importance

notice, and other rights on three months' notice. There is a depletion provision of 27.5 percent, but this provision calculated for each separate area may not exceed 50 percent of the net income after all other deductions for taxes, royalties etc. have been made. Essential materials for oil operations may be imported by a concessionaire duty free during the first 25 years, if similar materials are not readily available in Turkey.

A new amendment to the Turkish law, dealing with transmission and refining, has just been enacted, according to reports. But as of June 19, 1957, the text was not readily available.

Venezuela. Certain amendments were enacted by the Venezuelan Congress in 1954 to the basic Law of Hydrocarbons which took effect ten years earlier. Surface geology and geophysics may be done on areas outside the concession, provided proper notice is given to the Ministerio de Fomento. Special taxes of two bolivars per hectare (2.471 acres) payable annually in advance on initial exploration permit areas, are intended both to raise revenue and to cause the holder to evaluate the acreage more promptly and surrender the least prospective portion sooner. Higher exploration taxes apply after selection has been made. After ten years, if royalty accrues from production, generally the royalty tax is deductible from surface taxes due.

The establishment into law and actual practice of high bonus bids for new concessions in Venezuela is of major importance to the oil industry there. —**The End**

HYDROCARBON WELL LOGGING
(WORLD WIDE)

SPECTROMETRIC and CONVENTIONAL

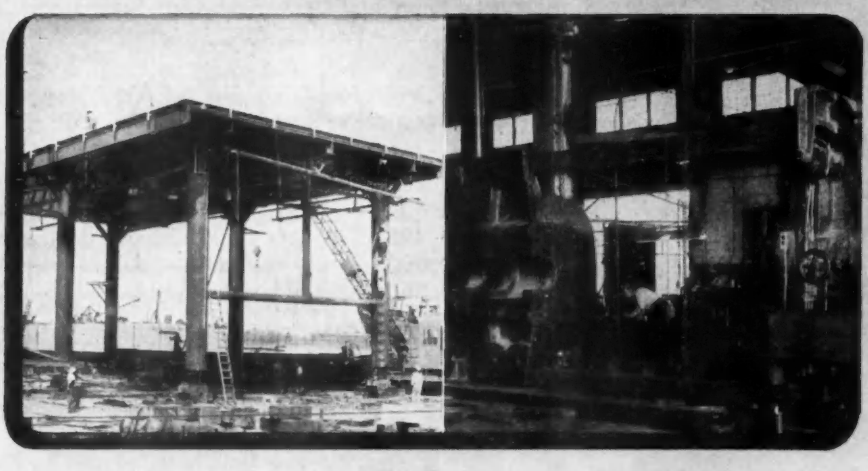
CARAN
ENGINEERING CORPORATION

MILAM BLDG. SAN ANTONIO

Branch Offices: Houston and Alice, Texas and Lafayette, Louisiana

For Tidelands Oil . . .

Peak Capacity, Nearby



this is **AVONDALE'S** story

A map illustrates the fact . . . that in the fan-shaped riches of the Tidelands, there is one centrally-located point for construction and repair. That point is Avondale, with four major divisions compactly grouped in the New Orleans area. Moreover, Avondale has the facilities—the capacities—the special production tools required by offshore operations. For a small job —quick repair of a piece of drilling equipment—there is Avondale's enlarged Oil Field Machine Shop. For the design and construction of an elevated deck drilling barge—a big job in every sense of the word—there are Avondale's vast facilities at the River Plant. Yes, when you want the best and you want it fast, your nearest and most complete source is Avondale . . .

ability • integrity • capacity

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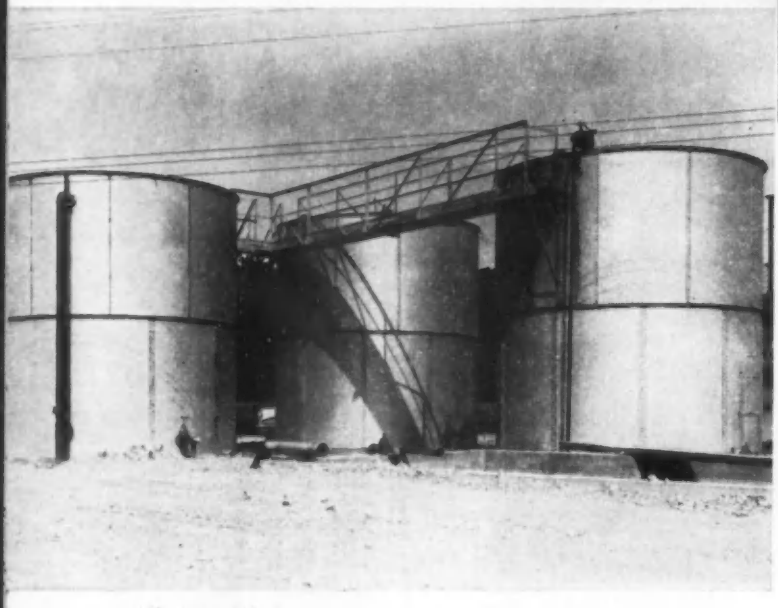
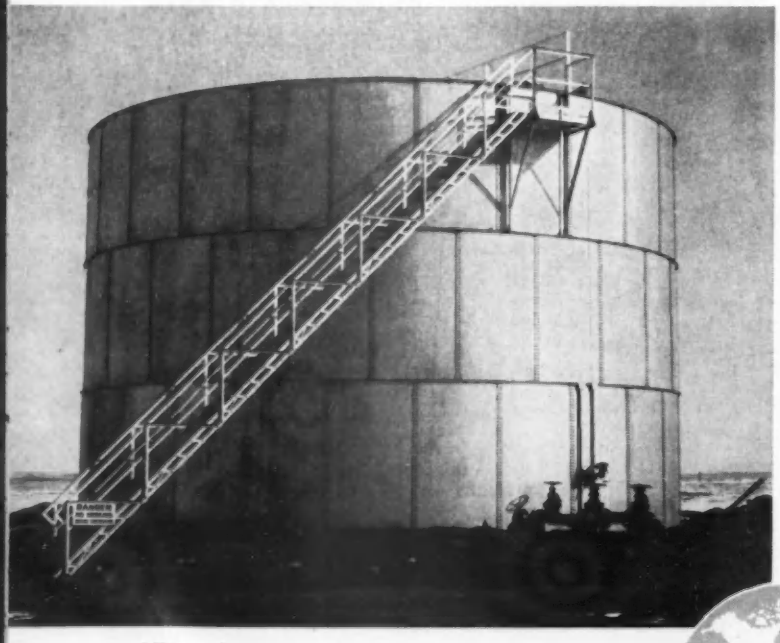
ABOUT BOLTED TANKS

Aluminum Sides and Deck, Rezo-Glas Bottom and 2′ Side Ring



All Rezo-Glas



All Steel

Bolted steel tanks can be delivered immediately* to your location in standard capacities of:

65 bbl.	300	2,000
100	500	3,000
130	750	3,333
195	1,000	5,000
200	1,500	6,666
250	All made to API Dimensions	10,000

*Delivered immediately means the time necessary to haul to location from any one of 45 correctly located Bolted Steel Tank stocks in the U.S. and Canada. National Supply Corp., our export agents, carry our tanks and parts in several foreign countries, including Venezuela.

Bolted Rezo-Glas** Plastic Tanks or Combination Plastic and Steel and/or Aluminum can be shipped in capacities up to 500 bbl. from our factory in Tulsa, Oklahoma.

Steel is available in painted finish or

HOT-DIPPED GALVANIZED AFTER FABRICATION

(National built the FIRST such tank in 1936)

After 20 years of service throughout the oil fields everywhere, thousands of these tanks are giving a good account of themselves:

- In Sour Oil Areas (corrosive oils and gases require them)
- In Humid Salt Air Areas (offshore and other locations)
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NATIONAL GALVANIZED AFTER FABRICATION STEEL TANKS require no painting for years after erection and they are PORTABLE.

TANK COMBINATIONS AVAILABLE ONLY from National include:

1. Painted Bolted Steel Tanks (flat or coned bottom)
2. All GALVANIZED Bolted Steel Tanks (flat or coned bottom)
3. ALUMINUM Deck, GALVANIZED Rings and PLASTIC Bottoms
4. ALUMINUM Deck, GALVANIZED Shell, 2′ Lower Rezo-Glas Ring, Rezo-Glas Bottom
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Take them anywhere — erect them — remove them in parts two men can handle with ease.

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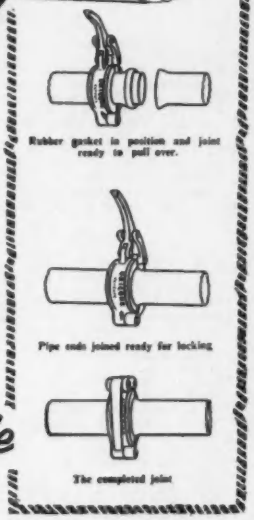
INSTANTANEOUS! JOINTS

A perfect seal in a matter of seconds

For temporary pipe lines 'Unicone' instantaneous joints are recommended. Comprising two parts only, they fasten with a "snap" ensuring a perfect seal in a matter of seconds.

For permanent or semi-permanent pipe lines 'Unicone' bolted type joints are usually employed and can be assembled far more quickly than any flexible joint giving positive anchorage.



Rubber gasket in position and joint ready to pull over.

Pipe ends joined ready for locking.

The completed joint

'UNICONE' REGD

Flexible Joints for all Pipelines.

Leakproof. safe. reliable

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The latest and most modern method of geophysical exploration that shortens the route to petroleum reserves by rigid instrumental recordings, indicating the existence or not of hydrocarbon accumulations, and approximate depth. Ten locations for a major oil company without error. Surveys conducted for cash fee and chance to earn small override, oil payment, leases or other interest, where saturation is indicated in commercial quantities. Information on request.

To establish conclusive proof of the accuracy of our geophysical work, we will, without cost to you, test and record a log of your well on tape, bearing your signature and ours, of your rank wildcat location, in advance of drilling, indicating the existence or not of petroleum in commercial quantities underlying the tested areas and approximately at what depth it may be found. The instruments are entirely self-operating during testing period.

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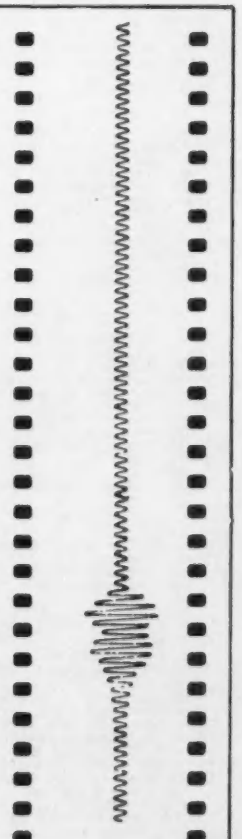

Specimen of log tape indicating saturation with break in zone

GALLOWAY PIPEGUARD

Introduces...

NEW POSITIVE TUBING PROTECTION

prevents corrosion and paraffin deposits

Oil and gas well tubing lasts longer — requires few costly workovers when coated with Galloway Pipeguard. Baked on for resistance to corrosion or air cured for paraffin prevention, these internal coatings mean real economy to your tubing operations.

- Protects against corrosion
- Prevents paraffin deposits
- Eliminates expensive workovers
- Insures *cleaner* transmission of oil and gas products

HERE'S PROOF:

A major producer* proved Galloway Pipeguard on 261 wells, (1,600,000 feet of pipe)... proved it positively successful in providing paraffin prevention and corrosion protection.
**Ask our representative.*

FASTER SERVICE:

Galloway is geared to serve the field promptly! Galloway's new, enlarged facilities insure accuracy and speed. Here is tubing protection engineered and applied for your specific problem.

ODIS GALLOWAY

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Write for a free brochure.

Please send me information about Galloway Pipeguard Internal Tubular Coatings including prices.

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For more data on advertised products, use Readers' Service Cards, last page.

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